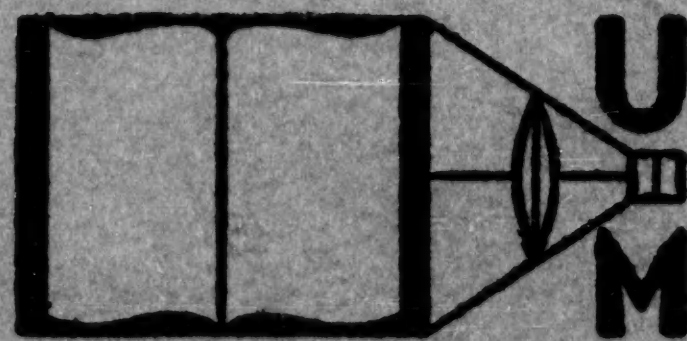


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U N I V E R S I T Y M I C R O F I L M S  
Ann Arbor, 1948



*Printed and Lithoprinted in U.S.A.*  
*University Lithoprinters, Ypsilanti, Michigan, 1948*



## INTRODUCTION

In the past this publication has been devoted exclusively to abstracts of doctoral dissertations, available in complete form as microfilm or paper enlargements. Volume VI Number 2 initiated a departure from this policy; the inclusion of abstracts of longer monographs of merit, in addition to dissertations.

The same conditions warranting microfilm publication of dissertations, namely size, expense of publishing through ordinary channels, delay in publication, and a limited but nonetheless important demand for copies, apply equally well to certain monographs of a specialized nature. Accordingly this and future issues will be divided into three sections instead of two, as in the past: 1) Abstracts of doctoral dissertations; 2) Abstracts of monographs (not dissertations); and, 3) A cumulative index of titles abstracted in preceding issues of Microfilm Abstracts.

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Eugene Power



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Subscription price, Five Dollars Per Annum in Advance  
Single Copies, Fifteen Cents

Entered as Second-Class Matter, October 3, 1917  
Postpaid

Acceptance for mailing at special rate of postage provided for in  
Act of October 3, 1917. Authorized by Act of October 3, 1917.

Postmaster: This journal is published weekly, except on  
Sundays and legal holidays.

Subscription orders, notices of change of address, and  
other communications should be sent to the Editor.

Advertisements should be sent to the Business Manager.

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Printed at the American Medical Association, 535 North Dearborn Street,  
Chicago, Ill.

Second-Class Postage Paid at Chicago, Ill.

Postage paid by addressee

Subscription price, Five Dollars Per Annum in Advance

Single Copies, Fifteen Cents

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Acceptance for mailing at special rate of postage provided for in

Act of October 3, 1917. Authorized by Act of October 3, 1917.

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Second-Class Postage Paid at Chicago, Ill.

Postage paid by addressee



## AGRICULTURAL CHEMISTRY

### RESPONSE OF SLASH PINE (PINUS CARIBAEA Morelet) TO VARIOUS NUTRIENTS IN NORFOLK SOILS IN FLORIDA

Ruthford Henry Westveld, Thesis (Ph.D.)  
Michigan State College, 1946

The response of slash pine seedlings during their first season's growth to various nutrients was studied in Norfolk sand in a greenhouse and in Norfolk fine sand in a nursery. Fifty-five soil treatments involving 2120 trees were studied in the greenhouse experiments during three seasons. Nineteen treatments involving more than 25,000 trees from which 1020 trees were sampled were used in the nursery experiments during two seasons.

When only readily available nitrogen, phosphorous, and potassium, either singly or in various combinations, were added to the soils, slash pine seedlings were not improved appreciably in all-round quality. On the other hand, when nitrogen or nitrogen and potassium were added to the soil in which 20 to 25 tons per acre of colloidal phosphate was mixed-addition of which changed the physical composition of the soil-the seedlings made marked response. Trees in such cultures had significantly longer stems and larger diameters than those in the check culture, and they were significantly heavier, both in shoot and root. Ten tons of peat plus readily available nutrients produced similar effects on the seedlings. Small amounts of colloidal phosphate-0.5, 1.0, and 5 tons per acre-plus readily available nitrogen and potassium, when added to the soil, produced positive response, but trees grown in such cultures were not significantly superior to those grown in an untreated soil.

Addition of nearly any single readily available nutrient or combination of nutrients increased branching of the trees, although often only temporarily.



Stem length was generally less in cultures supplied solely with readily available nutrients than in a check culture, while stem diameter and dry weight of trees were usually greater in the former. Type of soil treatment had no significant effect on root-shoot ratio.

The use of combinations of two or more of four nutrients studied resulted in more favorable response by the seedlings (except in one isolated case) than the use of a single nutrient. Nitrogen alone in a single application of 60 pounds of N per acre at the beginning of the experiment was actually very harmful to the seedlings.

Large quantities of nutrients such as 120 and 180 pounds per acre each of N,  $P_2O_5$ , and  $K_2O$  added to the soil in a single application at the beginning of the experiment depressed the growth of the seedlings.

Applying readily available nitrogen, phosphorous, and potassium in four equal installments produced more favorable response in the trees than a single application equal in quantity to four applications.

Although four applications of 30 pounds per acre each of N and  $K_2O$  in combination with 20 tons of colloidal phosphate produced greater response of slash pine seedlings than four applications of 15 pounds of each with phosphate, the difference between the trees in the two treatments was not significant.

Results in the nursery experiments were similar to those in the greenhouse experiments, but differences between treatments were in general not so great, due probably to less effective control of the former.

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Publication No. 997

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## ANATOMY

### A STUDY OF THE ANURAN DIENCEPHALON

José Guillermo Frontera, Thesis (Ph.D.)  
University of Michigan, 1948

This study is a contribution to the problem of the comparative anatomy of the diencephalic areas of the anuran amphibians. Numerous series of the brains of *Rana catesbeiana*, *Rana pipiens* and *Hyla* sp., cut in various planes and stained by the toluidine blue, Weigert's and pyridine-silver techniques were investigated.

The dorsal and ventral habenular nuclei, in the epithalamus of anurans, are comparable with the medial and lateral nuclei of higher forms. The dorsal nuclei are asymmetrical, the left nucleus being larger and more complex. All nuclei receive fibers of stria medullaris and discharge to the mesencephalic tectum and to the interpeduncular nucleus via habenulo-tectal and habenulo-peduncular fibers. Thalamo-habenular fibers connect the ventral nuclei with nucleus dorsomedialis anterior.

The thalamus proper shows a definite advance over the condition found in the urodeles. Several nuclear masses can be directly compared with the corresponding cell-groups of the reptilian brain. Among these are nuclei dorsomedialis anterior, dorsolateralis anterior and rotundus. The latter is an important center which receives strio-thalamic, tecto-thalamic, and ascending fibers from lower brain centers besides being interconnected with other thalamic nuclei. A dorsal nucleus of the lateral geniculate is recognized, its cells probably migrate from the lateral portion of nucleus dorsolateralis anterior under the influence of optic impulses passing in the axillary bundle. Dorsal and ventral lateral geniculate nuclei discharge to the tectum.



Anterior and posterior entopeduncular nuclei are found for the first time in phylogeny, associated with the lateral forebrain bundle (mainly with its ventral division discharging to tectal, tegmental and hypothalamic centers.

The preoptic region contains three nuclei receiving fibers of the lateral division of the medial forebrain bundle in addition to fibers of stria terminalis and the ventral olfactory projection tract. They discharge to the habenular region, probably to nucleus dorsomedialis anterior and to midbrain tegmentum through the periventricular fiber system.

An anterior portion of the ventral hypothalamus borders the preoptic recess over the chiasma ridge. This area possibly receives ventral olfactory projection fibers. Nucleus periventricularis arcuatus, bordering the infundibular recess, forms the rest of the ventral hypothalamus. The dorsal hypothalamus is coextensive caudally with the tegmental gray. All hypothalamic centers receive fibers of the medial division of the medial forebrain bundle in addition to other connections.

The connections of the post-optic commissural and ascending systems were not analyzed pending further study of mesencephalic and rhombencephalic centers.

The results of the investigation show that the anuran diencephalic region has progressed considerably from the urodelan type, pointing to a possible closer affinity between the former and the reptilian phylogenetic histories, as has been recently proposed by some workers in the field of paleontology.

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Publication No. 1048

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## THE DEVELOPMENTAL BASIS FOR THE CONTINUITY OF THE FASCIAL PLANES OF THE ABDOMEN AND PELVIS

Mark Allan Hayes, M.D., Thesis (Ph.D.)

University of Michigan, 1948

Since the significance of adult anatomical relations can be evaluated most clearly by a study of their development, there seemed to be promise in planning such an investigative attack on the fasciae of the adult abdomen and pelvis. In any such study the concept of embryological timing is basic. Any structural modification in development depends on the coincidence of many operating influences such as the precise degree of tissue differentiation attained within the structure itself, the comparable conditions in adjacent tissues and the success of a growing primordium in attaining an exact configuration at the critical moment. Even more complex are these factors when two independently originating structures join and thence progress along a common developmental course. Such changes as they relate a structure to its surroundings can be summarized in the term primary growth. As these changes imply intrinsic differentiation and growth within a single structure independent of its environment, they can be characterized as secondary growth. These processes play an important part in the establishment of the adult relationships of the viscera, the body wall and their associated fasciae. Primary growth accounts for the relative migration of structures; secondary growth provides for local alterations in a structure and its adnexae.

During a relatively restricted interval, embryonic peritoneal surfaces in apposition in a manner predisposing to loss of the primitive mesothelial covering and a subsequent fusion of the maturing connective tissue elements of the tunica propria produce



a single indivisible adult layer. Minor variations in timing will cause deviations from an anticipated normal extent of this fibrous lamina; major discrepancies in timing will produce either abnormal positions of gastrointestinal segments or persistence of the foetal mesenteries.

These two processes of development produce different types of fasciae in the adult: the fasciae resulting from organ migrations appear as regional specializations of the adult extraperitoneal connective tissue, the texture of which is loose and spongy and which are designated migration fasciae. Everywhere this fascia is directly continuous with the generalized extraperitoneal connective tissue. Examples of such a fascia are the perirenal fascia, the umbilical vesical fascia, the perirectal migration fascia and the fascia of the spermatic vessels. The fasciae resulting from fusions form this membranous layers and are termed fusion fasciae; these are continuous at some one edge with two leaves of adult peritoneum. Such fasciae are the fascia of the dorsal mesogastrium, the retropancreatic and prepancreatic fasciae, the umbilical prevesical fascia, the mesocolon fusion fasciae and the interconnected fusion fasciae of the pelvis.

These two dynamic processes operate in conjunction with a static concept of a third type of fascia. In its primitive simplicity the abdominopelvic cavity is delimited by a musculo-bony wall, the inner surface of which is lined by a fascia intrinsic to the wall itself, the so-called parietal fascia.

With a clear understanding of the embryological changes that occur during the migrations of structures, rotations of the gut, and alterations and fusions of mesenteries, it is possible to predict and confirm the presence of fasciae of these three origins by studying a series of developmental stages. Their presence and modifications have been presented as the logical end results of normal development.

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Publication No. 1056

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THE ANATOMICAL BASIS FOR CERTAIN  
REFLEX AND AUTOMATIC EYE MOVEMENTS

John Woodworth Henderson, M.D., Thesis (Ph.D.)  
University of Michigan, 1948

With progressive phylogenetic development the dominant level of control of eye movement shifts from lower to higher brain centers and finally to the cerebral cortex. One of the more primitive levels is that of the vestibular system, and the characteristic rotational and post-rotational responses in terms of conjugate eye movements have been verified in this report. In addition, it is shown that there is a cortical modification of such ocular movements in the rabbit, expressed in terms of optokinetic nystagmus. This requires a cortical arc. The paper emphasizes the importance of visual stimuli in modifying (and even inhibiting) such eye movement due to vestibular stimulation.

Consideration of the anatomical material in the monkey shows that the superior colliculi receive relatively few direct optic fibers. This is in disagreement with the older view that many reflex ocular movements in primates have such an origin. The striate and parastriate areas of the occipital lobe displace the position of importance of such direct connections in the primates. Thus ocular movements set up in response to visual stimuli require the participation of striate and parastriate cortical arcs. In such instances they partake of the nature of automatic rather than reflex eye movements.

The anatomic systems underlying such automatic eye movements, and particularly the arcs from the occipital cortex to superior colliculus, have been studied in detail. It has been possible to trace

direct connections from both area 17 and area 19 of the occipital lobe into the midbrain, and to relate such connections to the localization pattern of the midbrain nuclei themselves. Such an anatomical arrangement has been further verified by direct stimulation of the brain areas concerned and by recording the eye movements produced.

The fundamental differences in relations of the discharge path (the cortico-bulbar system) from area 8 (the voluntary eye center) to the motor nuclei related to eye movements as compared with those of the internal cortico-tectal system from striate and parastriate cortex (the automatic eye centers) are stressed. These differences in course of the pathways are shown to be of considerable clinical significance.

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Publication No. 1057

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## ANIMAL HUSBANDRY

### THE GENETIC HISTORY OF THE ARABIAN HORSE IN AMERICA

Amin S. Zaher, Thesis (Ph.D.)  
Michigan State College, 1948

The blood of the Arabian horse was introduced to the United States of America through the horses of the Spaniards.

As early as 1733-1747 the pure Arabians were imported and were used for crossing with some American mares found at that time.

Importations were rather slow, and in small numbers until a little before 1906, when Huntington, Ramsdell, Spencer Borden, Hamidie Society, and Davenport imported more stallions and mares, and the Arabian Horse Club of America started registrations.

Importations were more effective later when Brown, Kellogg, Selby, Dickinson, Van Vleet, Babson, and others more interested in Arabians imported several animals of good quality. Since then the Arabian horse population in the United States has been steadily increasing.

In order to study the genetic history of the registered Arabian horses since the foundation of the Arabian Horse Club up to 1946, the data was taken from the Arabian Stud Book V, and its supplement, and the approximate method of calculating inbreeding and relationship coefficients developed by Wright and McPhee (1925) was used in the analysis of this data.

Two hundred male and female pedigrees were chosen at random from four different periods, starting 1907-1916 up to 1937-1946.

The inbreeding and relationship coefficients were calculated by the use of International Business Machines cards.

The results obtained can be summarized in the following:

1. The inbreeding coefficient for the Arabian horse breed of America rose gradually from 1.0% in 1907-1916, to 4.8% in 1937-1946.

2. The inter se relationship in the breed was 1.0% in 1907-1916, 4.0% in 1917-1926, 2.0% in 1927-1936, and 4.0% in 1937-1946.

3. The actually found coefficients of inbreeding were higher than the expected inbreeding from inter se relationship, and this indicated the tendency toward the formation of separate families.

4. The highest relationship to the breed was for Hamrah #28, who was imported by Davenport in 1906. His relationship to the breed was almost constant through the different periods. It was 7.5%, 8.3%, 5.5% and 7.0%, respectively.

5. Skowronek, a horse owned by Crabbet stud in England and tracing back to Egyptian origin on his male line, had the next higher relationship to the breed in 1937-1946 after Hamrah, his relationship to the breed came through some imported sons and daughters of his to America.

6. Due to the fact that there were not enough all-Arabian shows, there were no means to study the systems of breeding the outstanding animals.

7. The majority of the foundation animals were imported by Davenport from the desert and others imported from Crabbet Stud in England.

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Publication No. 998

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## ART AND ARCHAEOLOGY

### ARCHITECTURAL TERRACOTTAS IN THE GREEK ARCHAIC PERIOD

Alva Doris Elford, Thesis (Ph.D.)  
Bryn Mawr College, 1942

A handbook, illustrated with line drawings and maps, containing in the fourth chapter a more detailed study of the Laconian scheme.

Chapter I, General Remarks, discusses briefly: the origin, early history, and development of terracotta roof-tiles; the respective meanings of tegula and imbrex; the use of nails to secure the various members of the revetment; the problem of whether roof-tiles were bedded in clay; roof construction; the revetment in general; architects' marks; stamps on tiles; technique of decoration; and colour schemes.

Chapter II, Terminology, discusses each of the orthodox members of the revetment, and the more important sports, under the following headings: name - English, ancient Greek, modern Greek, Latin, Italian, German; description; its use, or the schemes of which it was characteristic; its history.

Chapter III, Schemes of Revetments, using as the basis of differentiation the shape of the cover-tiles, divides the material from the Mediterranean region into schemes of revetments as follows: Convex cover-tile schemes - 1. Northern East Greek, 2. Laconian, 3. West Greek, 4. Etruscan; Angular cover-tile schemes - 1. Southern East Greek, 2. Corinthian, 3. Aetolian, 4. Athenian. Wherever feasible a particular revetment, or the material from one site characteristic of the scheme, or of some phase of the scheme is discussed at greater length. Find spots with approximate dates are given for each scheme.

Chapter IV, the Laconian schemes, compares the decorative motives of the Laconian disc acroteria and antefixes with the decorative motives common to Laconian vases, and attempts to arrive at a date for the terracottas.

Chapter V, Conclusion, sums up the evidence for the division into schemes, discusses briefly the evidence for interrelation among the schemes, and the development towards a koine, in both terracotta and stone.

The illustrations are scattered throughout the text, for the most part accompanying the textual discussion. The notes are gathered at the ends of the chapters. The bibliography is suitable for a handbook.

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Publication No. 1086

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## BACTERIOLOGY

### A STUDY OF COLIFORM ORGANISMS IN MILK

- I. Incidence and selectivity of media
- II. Percentage distribution of Escherichia,  
"Intermediate", and Aerobacter
- III. Probable source

Saeed M. K. Kheshgi, Thesis (Ph.D.)  
Michigan State College, 1948

An ecological study of the coliform group of bacteria was made in raw and pasteurized milk, greater emphasis being given to the latter.

Four standard Presumptive Coliform Test media, viz. brilliant green lactose bile broth, formate ricinoleate broth, violet red agar and desoxycholate agar, were compared for the detection of coliform organisms in milk. The Standard Methods for the Examination of Dairy Products (1941) was strictly followed for the different techniques and procedures used.

A general correlation of concurrent increase or decrease of the coliform and standard plate counts was discerned in raw milk but not in pasteurized milk.

In raw milk brilliant green lactose bile broth proved as efficient as desoxycholate agar but violet red agar gave 1.6 times higher coliform count than formate ricinoleate broth. A comparison of media, using pasteurized milk, revealed that formate ricinoleate broth gave 1.2 times, violet red agar about 1.7 times and desoxycholate agar 1.8 times higher coliform counts than did brilliant green lactose bile broth. Desoxycholate agar, giving a higher coliform count than liquid media and more and larger typical dark red colonies than violet red agar, was selected as the best presumptive medium for the coliform count in pasteurized milk.

The aberrant coliform organisms, constituting 13 per cent of the total coliform count in raw milk, belonged to the microaerogenic and anaerogenic types. The presence of these aberrant coliform organisms, as shown by atypical colonies on violet red agar and desoxycholate agar, was insignificant in pasteurized milk.

The percentage distribution of the sections, Escherichia coli, "Intermediate" and Aerobacter aerogenes, was determined in raw and pasteurized milk by IMViC reactions. Thirteen of the possible 16 IMViC types in raw milk and 11 in pasteurized milk were encountered.

Excepting a few samples indicating fecal pollution, no definite source of contamination was ascertained in raw milk. However, the presence of coliform organisms in 65 per cent of the bottled milk samples was decidedly the result of improper pasteurization or recontamination as revealed by the absence of these organisms in a great majority of vat samples.

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## A STUDY OF THE BINDING BETWEEN SULFADIAZINE AND SERUM PROTEINS

Leonard A. Mattano, Thesis (Ph.D.)  
Michigan State College, 1948

Sulfadiazine-serum protein precipitated between pH 9.2 and 7.0 by the addition of dilute phosphoric acid to a solution of sodium sulfadiazine and Brucella anti-serum was found to be bactericidal against Brucella abortus in the presence of fresh normal rabbit serum to serve as complement.

The above serum proteins were identified by electrophoretic analysis and found to consist of globulins, mainly  $\gamma$ -globulin, and a small amount of albumin. The sulfadiazine anion combined with the positively charged positions in the serum protein molecule. In the precipitation of sulfadiazine in the presence of serum at pH 4.0, an electrophoretic study revealed that the  $\alpha$ -, and  $\gamma$ -globulins remained in the filtrate, and the albumin and  $\alpha$ -globulins were removed with the precipitate.

The crystals, which were formed in a solution of serum and sodium sulfadiazine at pH 9.2 and at 4°C., contained serum protein which was found to have an electrophoretic mobility close to that of  $\beta$ -globulin.

At pH 7.7 sulfadiazine reacted with one molar solutions of lysine, arginine and n-butyl amine, but did not react appreciably with one molar solutions of acetic acid, glutamic acid, urea, tyrosine, histidine, threonine, and glycine. The sulfadiazine was found to react with positively charged areas in the amino acids, such as the  $\epsilon$ -amino group of lysine and the guanidinium group of arginine.

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Publication No. 991

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## ANTIBODY RESPONSE OF TURKEYS VACCINATED WITH FORMALIN INACTIVATED NEWCASTLE DISEASE VIRUS

Shamseldin H. Rached, Thesis (Ph.D.)  
Michigan State College, 1948

The object of this work was to study the antibody response of turkeys through serological tests at certain intervals after vaccination with formalin inactivated Newcastle disease virus followed by challenge with virulent virus at the termination of the study.

### Experimental Procedures:

- 1) Strains Nc 46-967, chicken origin, and TD, turkey origin, of Newcastle disease virus were used to prepare vaccines consisting of infected allantoic fluids inactivated by formalin to a final concentration of 0.1 per cent.
- 2) Seven turkeys which had not been exposed to Newcastle disease were divided into 3 groups of 2 turkeys each, one turkey for the Nc strain and the other for the TD strain. The 7th turkey for the Nc strain and the other for the TD strain. The 7th turkey served as a control. The turkeys in Group 1 received a single intramuscular injection of 1.0 cc. of the vaccine and the turkeys in Groups 2 and 3 received 2 intramuscular injections of 1.0 cc. each of the vaccine with an interval of 1 and 2 with an interval of 1 and 2 weeks, respectively.
- 3) Four turkeys which survived the experiment together with 3 controls were challenged 10 months after vaccination with virulent virus.
- 4) Sera were collected before vaccination; at 1, 2 and 3 weeks; 1;  $1\frac{1}{2}$ , 2,  $2\frac{1}{2}$ , 3, 4 and 9 months after vaccination and 12 days after challenge and stored at -35 C for subsequent tests.



5) Serum samples were tested by hemagglutination-inhibition and serum neutralization tests.

Results:

1) A fair degree of correlation of the neutralizing capacity and the inhibitory power of the serum was observed particularly during the ascending titer period.

2) One hemagglutinin unit was found to correspond to from 2 to 10 million embryo lethal doses of a virus having a titer of from  $10^{-8}$  to  $10^{-9}$ .

3) Dilution of immune serum with nutrient broth 1 in 10 decreased its neutralizing capacity from 20- to 100-fold.

4) Turkeys vaccinated with the Nc strain showed significant neutralizing capacity and inhibitory power for 3 and 4 months, respectively, after vaccination.

5) Turkeys vaccinated with the TD strain showed only a negligible serological response.

6) A subclinical Newcastle disease infection of the turkeys occurring 4 to 8 months after vaccination produced a marked serological response.

7) On challenge with virulent virus, clinical symptoms of Newcastle disease were not observed in the vaccinated turkeys which had been exposed to the subclinical infection.

8) Sera collected 12 days after challenge revealed that 2 turkeys were hyperimmune to Newcastle disease. In the other turkeys there was a significant response to challenge as revealed by an increase of the neutralizing capacity and inhibitory power of the serum.

9) Efforts to isolate the virus from turkeys killed 5 weeks after challenge failed to reveal the presence of the virus in the spleen, the air sac membranes and the yolk material of an unfertile egg.

10) Vaccine prepared from formalinized Newcastle disease infected allantoic fluid of high antigenicity would be effective for immunization of turkeys against a potential infection with the disease.

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Publication No. 994

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EFFECTS OF CERTAIN ANIONIC, CATIONIC, AND  
NON-IONIC AGENTS ON GROWTH OF ESCHERICHIA COLI,  
SALMONELLA PARATYPHI B, AND STAPHYLOCOCCUS AUREUS

Charles Gainor, Thesis (Ph.D.)  
Michigan State College, 1948

A systematic study was made of the effects of certain anionic agents (Duponol OS, Igepon AP, Tergitol 7, Naconol NRSF, Nekal BX), cationic agents (Roccal, CTAB, LPC), and non-ionic agents (Emulphor ON, Triton X-100) on the growth of E. coli, S. paratyphi B, and S. aureus.

Growth counts over periods of 0, 4, 7, 10, and 24 hours showed that a 1-50 concentration of Nekal BX and Tergitol 7 completely killed E. coli in 24 hours, whereas only Nekal BX reduced the count of S. paratyphi B by more than 99 per cent in the same period. Germicidal activity of Roccal and CTAB was as marked at pH 5.2 as at pH 8 against the gram-negative organisms, although these compounds were more effective in the alkaline range against S. aureus. LPC was most effective in the alkaline range against all three organisms. The non-ionic compounds were not germicidal, although they did reduce the counts of all three organisms over the growth-curve period.

Determinations of pH made concurrently with growth-curve platings showed arrested deviations from the normal trend in pH shift. These determinations might serve as a possible indicator of interference with the normal metabolic activities of the organisms.

Test-tube bacteriostatic tests with the anionic compounds indicated no positive proof of stasis against the gram-negative organisms, although stasis was noted against S. aureus. Turbid and particulate nature of some of these solutions prevented drawing exact conclusions. The three cationic agents exerted



static effects against E. coli and S. aureus, whereas only LPC at pH 5.2 exerted bacteriostasis against S. paratyphi B.

Surface-tension controls, with the majority of the compounds, substantiated the general theory that rapidity of attaining equilibrium is a function of concentration. LPC did not attain equilibrium within 48 hours in any of the concentrations used.

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Publication No. 999

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## BIOLOGICAL CHEMISTRY

### OBSERVATIONS ON THE PATHOLOGY OF NUTRITIONALLY INDUCED MUSCULAR DYSTROPHY IN THE GUINEA PIG

A. M. Pamukcu, Thesis (Ph.D.)  
Michigan State College, 1948

The objectives of the investigation were to induce muscular dystrophy, attempt to differentiate the cells participating in the degeneration and to study the processes of regeneration of muscle cells at different stages of development.

#### Materials and Methods

The guinea pigs (220-310 gm. wt.) were divided into three groups of eight animals each. Two animals from each group were kept as controls.

Group I was used to produce muscular dystrophy by feeding a synthetic diet according to the formula of Davis et al (1938), supplemented daily with 0.5 gram per animal of U. S. P. grade cod-liver oil, and by an ascorbic acid tablet on the alternate days. The guinea pigs were killed at different stages of the disease.

To differentiate the cells participating in degeneration and regeneration of muscle fibers, vital staining with trypan blue was carried out with guinea pigs of Group II which were fed the same synthetic diet and supplements as for Group I. The amount of dye given in each instance was determined by the weight of the animal and was administered on alternate days. The first injections were made on the 20th day of the experiment. Five injections were made by the subcutaneous route. The Group III animals were used to study different stages of the regeneration of damaged muscle fibers. The animals received the same diet and supplements as above until they began to show some difficulty in locomotion.



Then the cod liver oil was discontinued. The diet was replaced by rabbit pellets, supplemented by an ascorbic acid tablet on alternate days. The guinea pigs were killed 1, 3, 6, 9, 12, 15 days after having been fed the rabbit pellets.

Specimens taken from various muscles were fixed, sectioned, stained by the ordinary pathological methods.

### Results and Conclusions

After a period of feeding which ranged from 22 to 36 days, there was usually a decline in body weight which occurred synchronously with the appearance of decreased activity, slow locomotion, difficulty in rising, and finally paralysis of legs followed by death. As long as the administration of cod-liver oil was continued no spontaneous recovery took place.

The gross pathological changes appeared to be confined primarily to skeletal muscles which were pale, yellowish gray streaked, patchy and showed a cooked, moist appearance. The lesions showed a symmetrical and bilateral distribution.

The microscopic changes consisted of coagulation necrosis of skeletal muscles which showed a waxy, hyaline appearance followed by myoregeneration. The sarcolemma which escaped destruction were completely filled with muscle spindle cells, multinucleated syncytial mass, giant cells and histiocytes, giving rise to a "muskelzellenschlauche" of Waldyer. Histiocytes and giant cells phagocytosed the dye to a large extent. Not all muscle spindle cells and multinucleated syncytial masses, of muscular origin engulfed vitally injected trypan blue dye during their development.

Myoregeneration arose from the stumps of the old fibers by continuous outgrowth and was complete. Nuclear division in regenerating muscle fibers took place mostly by amitosis. Sarcolemma appeared to be a product of regenerating muscle cells.

Not all cardiac muscles showed hyaline degeneration.

Publication No. 993

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## BIOLOGY

### QUANTITATIVE ESTIMATION OF PLANKTON FROM SMALL SAMPLES OF SEDGEWICK-RAFTER-CELL MOUNTS OF CONCENTRATE SAMPLES

Robert E. Serfling, Thesis (Ph.D.)  
University of Michigan, 1948

The distribution of plankton in a Sedgewick-Rafter counting chamber was investigated by analysis of frequency distributions of square-millimeter fields containing recorded numbers of plankton. Three diatoms, of the genera Cyclotella, Fragilaria, and Tabellaria, respectively and a flagellate, Ceratium hirundinella, were included, separately and in combination, at three concentrations. A study was made of the changes in the frequency distribution of the fields resulting from combination of fields in random samples of five, ten, and twenty fields. The observed distributions were compared with expected distributions of Poisson exponential functions with the same mean as the observed distribution.

The distribution of sampling units, each formed of several fields approached the distribution of the Poisson function as the number of random fields included in the sample unit was increased. Ten to twenty fields were required before approach to the Poisson became satisfactory for all the forms studied. Departures were greater for combinations of species than for single species.

Experimental studies were made of the limitations of Fisher's "t" and of Lord's "u" test, employing range as an approximation to standard deviation, in testing significance of differences between means of small random samples drawn from Poisson distributions and from the observed Sedgewick-Rafter-cell distribution. When the mean of the parent distribution was 5.0, or larger, close conformity with theoretical values was obtained for the absolute value of deviations.



A criterion is introduced by use of which the unit sample area may be increased for a given counting cell preparation until reasonable certainty is attained that the mean of the unit sampling areas will be at least 5.0.

A method is given whereby estimates of plankton populations may be standardized. Proposed modifications of present practice include:

1. Employment of a flexible unit counting area which may be adjusted in size, through application of a sample density criterion, to insure a minimum sampling variance.

2. Use of the "u" test, based on sample range as estimate of standard deviation, to furnish a tentative estimate of significance of difference between a concentrate sample under microscopic examination and results of previous counts; enabling extension of counting when the outcome is questionable.

3. Construction of a sampling plan, for critical work, to permit isolation of variability attributable to unequal distribution of plankters in the concentrate vial and also that arising from local inequalities in distribution of plankton in the habitat.

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BOTANY

A PHYTOGEOGRAPHIC STUDY  
OF ALASKAN MOSSES

Alton McCaleb Harvill, Jr., Thesis (Ph.D.)  
University of Michigan, 1948

After a brief introduction, the physiography, geological history, climate, and vegetation of the Alaska-Yukon region are discussed. These chapters are followed by a list of the 433 species of mosses which have been collected in the area. The world distribution, as well as the known Alaskan ranges of each species, is outlined and, in addition to the literature references, citations are given to the specimens which have brought together by the University of Michigan Herbarium prior to, and during the course of this study.

The discussion of the distribution of mosses is developed on the basis of two major vegetational zones in the region of study, representing two geographic, or floristic elements are recognized in the moss flora and a discussion of the affinities and probable origin of the flora is based on these data.

The West American-European group of mosses is recognized for the first time in the flora and in order to explain this unusual distributional pattern, the writer has utilized data from Tertiary paleobotany to postulate a climatic segregation of biotype material in Pliocene time leading to the development of an eastern American and a western American element.

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Publication No. 1055

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## THE ASSOCIATIONS OF BARK-INHABITING BRYOPHYTES IN MICHIGAN

Edwin Allen Phillips, Thesis (Ph.D)  
University of Michigan, 1948

The introduction includes a brief historical background and a critical evaluation of ecological terms that have been applied to bark-inhabiting bryophytes. An annotated list of bryophytes with keys to species is followed by chapters on field and laboratory investigation methods.

The discussion of the twelve associations of bark-inhabiting bryophytes recognized in Michigan is based on 14 tables that summarize data for constancy and coverage of the component bryophyte species and correlate them with region, tree species, trunk diameter, and exposure. These associations are also based on the new concept of the geographic distribution of species within the range of the association.

Investigations, special studies, and critical observations establish the fact that moisture is the most important factor that affects the development and distribution of bark-inhabiting bryophytes in Michigan. This fact together with a consideration of the distribution of the various species of bryophytes on the different trees in the regions within the state, indicates that the species of tree is not an important factor unless the moisture is very limited.

Pioneer and more xerophytic species include Frullania spp., Radula complanata, Ptilidium pulcherrimum, and Homomallium adnatum. These are replaced in habitats of optimum moisture relations by Pylaisia Selwynii, Leucodon sciuroides, Porella platyphylloides, Neckera pennata, and Anomodon minor in approximately this order.



Preliminary studies of the correlation of light intensities and the development and distribution of bryophytes reveal no consistent differences between trees with and without bryophytes. Other special studies include: (1) a study of reverse succession due to thinning of a plantation of Populus deltoides, a study of vertical and horizontal distribution of bark-inhabiting bryophytes on Fraxinus nigra in an optimum habitat, and (3) a study of successions on young and old Acer saccharum in the Upper Peninsula. These studies are summarized in eight tables.

A table summarized the constancy and coverage of the thirteen most common species of bryophytes in their own and in other associations. The high constancy of many species in other associations indicates that these associations intergrade either because succession is taking place or because competition is intense. Thus several associations are alike in composition and occur in similar habitats that are within the tolerance range of the different associations.

A map-chart indicates the main divisions, localities of investigations, moisture regions and average annual evapotranspiration. A table correlates the regions, tree climaxes, and moisture with the bryophytic associations, and still another table the occurrence of bryophytic species on various tree species in the different regions of Michigan. The last table summarizes the climatological data that are used in analyzing the results of the association tables.

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## CHEMICAL ENGINEERING

### THE HYDROGENATION OF COAL AT HIGH TEMPERATURES

Robert Eugene Howard, Thesis (Ph.D.)  
Purdue University, 1942

The hydrogenation of Indiana fourth seam coal was investigated without the use of vehicles or catalysts in the temperature range from 400C. to 575C. and at pressures up to 4500 pounds per square inch. Apparatus consisted of a pearlitic manganese steel bomb which was operated as a constant-volume, batch system. Hydrogenation was effected both with approximately equal molar quantities of carbon and hydrogen in the reaction space and with a large excess of the carbonaceous material. Data are given for the variation of gas composition with time for various temperatures, and the equilibrium values of gas composition are determined. It appears that the presence of hydrogen modifies the ordinary distillation of coal tremendously and evidence is given to show that the volatile matter distilled from the coal is ultimately reduced to methane by a combination of cracking and hydrogenation. The effect of successive hydrogenation of a given coal mass with fresh batches of hydrogen is shown to decrease the rate of reaction, although it does not affect the final equilibrium concentrations attained. For the case of equal molar amounts of carbon and hydrogen reacting, data are presented for the variation in methane concentration, ethane concentration, heating value of gas, per cent solid residue, amount of ammonia in the gas, etc., as a function of temperature and pressure in the temperature range 400C. to 575C. and in the pressure range of 100 to 700 pounds per square inch (initial pressure at room temperature).

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Publication No. 985

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## THE THROUGH-DRYING OF POROUS MEDIA

Joseph Allerton, Thesis (Ph.D.)  
University of Michigan, 1948

The object of this investigation has been to study the basic mechanism and to measure experimental rates of drying of filter cakes. Drying by passing a gas through a porous media and by vaporizing liquid contained in the media has been termed through-drying in this thesis.

Through-drying experiments were performed on porous beds composed of uniform glass balls, crushed quartz, and one binary mixture of glass balls using water as the vaporizing liquid and air as the gas passing through the bed. The particles varied in size from 10/12 to 115/150 mesh. Although fundamentally the same, the process has been divided for convenience into two periods: maximum rate drying and falling rate drying. During maximum rate drying, the water in the bed presents so much surface for mass transfer that air passing through leaves essentially saturated with water at the adiabatic saturation temperature. The air picks up moisture in the bed so quickly that drying may be considered to take place in a narrow zone of vaporization which gradually moves down the wet bed, leaving a dry bed above. When the bottom of the narrow zone reaches the bottom of the bed, falling rate drying commences.

For the low absolute humidities used in the experiments, drying rates,  $r$ , have been correlated on the basis of vaporization efficiency,  $E$ , with the maximum drying rate,  $R$ , the moisture content,  $W$ , and a drying factor,  $Y$ , by the following equation:

$$\frac{r}{R} = E = 1 - e^{-YW}$$



The drying factor,  $Y$ , has been correlated with moisture content,  $W$ , particle size,  $D_{in.}$ , and either the modified Reynolds number,  $\frac{DG}{\mu}$ , or the complete Reynolds number,  $\frac{DG}{\mu_{xm}}$ , as follows:

$$Y(\text{ft.}^2/\text{lb.}) = 2.72 \left(\frac{DG}{\mu}\right)^{0.215} (D_{in.})^{-0.350} (W)^{-0.36}$$

or

$$Y(\text{ft.}^2/\text{lb.}) = 2.36 \left(\frac{DG}{\mu_{xm}}\right)^{0.215} (D_{in.})^{-0.350} (W)^{-0.36}$$

The moisture content,  $W$ , has been expressed in terms of weight per cross-sectional area of bed (lbs. per sq. ft. in the above equations) since thickness does not influence drying rates with small pressure drops across the bed.

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Publication No. 1039

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CHEMISTRY

NITRATION OF THE HIGHER ALKANES

Mortimer Cooper Denison, Thesis (Ph.D.)  
Purdue University, 1940

Pure hendecane, decane and dodecane have been nitrated to form mono-nitro compounds in both the liquid and vapor phase. The optimum temperature, contact time and ratio of reactants for the vapor-phase nitration have been determined. Various derivatives have been prepared from the nitroalkanes.

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Publication No. 984

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# THE FORMAL OXIDATION POTENTIAL OF THE CERIC-CEROUS SULFATES

John McCallum, Thesis (Ph.D.)  
Michigan State College, 1948

The formal oxidation potentials of the ceric-cerous sulfates have been measured at various concentrations of sulfuric acid, ceric sulfate, and cerous sulfate. The effect of small amounts of ammonium sulfate has been determined and with measurements at three temperatures, an estimation of the decrease in heat content ( $-\Delta H$ ), for the reaction  $\frac{1}{2}H_2 + Ce^{++++} \rightarrow Ce^{+++} + H^+$ , has been made.

The formal oxidation potential was found to conform with the relation

$$E_{Cell} = E^0(\text{formal}) - \frac{RT}{F} \ln \frac{m_{Ce^{+++}}}{m_{Ce^{++++}}} \frac{x m_{H^+}}{x P_{H_2}^2}$$

where  $m_{Ce^{+++}}$  and  $m_{Ce^{++++}}$  are the stoichiometric molal concentrations of the cerous and ceric ions,  $m_{H^+}$  is twice the stoichiometric molal concentration of sulfuric acid,  $P_{H_2}$  is the partial pressure of the hydrogen in atmospheres,  $R$  is the gas constant,  $T$  the absolute temperature,  $F$  is the faraday, and  $E_f^0$  has the following values:

$$\text{at } 15^\circ C. \quad E_f^0 = 1.463 \pm 0.005 \text{ volts}$$

$$\text{at } 25^\circ \quad E_f^0 = 1.459 \pm 0.005$$

$$\text{at } 35^\circ \quad E_f^0 = 1.457 \pm 0.005$$

$E_f^0$  was found to have these values within the following range of concentrations:

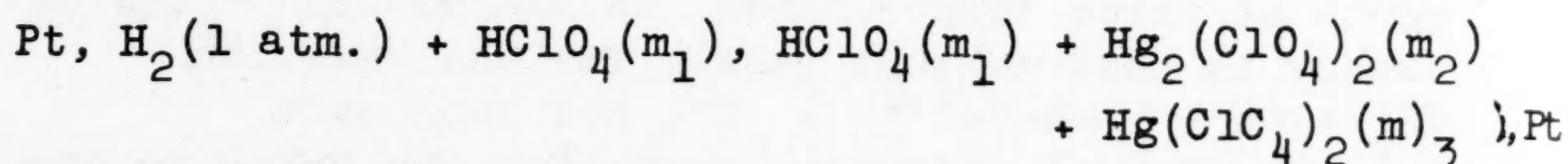
$$0.06m < m_{H^+} < 2.0m; \quad 0.15 <$$

$$\frac{m_{Ce^{+++}}}{m_{Ce^{++++}}} < 18.0; \quad 0.0 < m_{Ce^{+++}} + m_{Ce^{++++}} < 0.02m.$$

## Measurements on the cell

Pt,  $H_2(1 \text{ atm.}) + H_2SO_4(m_1)$ ,  $H_2SO_4(m_1) + Ce_2(SO)_3(m_2) + Ce(SO_4)_2(m_3)$ , Pt have been computed in terms of mean activities of the species shown and with the assumption of 100% ionization. It was found that application of the Debye-Huckel relations for mean activity coefficients gave straight line relations between the observed e.m.f.'s of the above cell and its total ionic strength for the condition that the ratio  $m_1:m_2:m_3$  is a constant. Different ratios,  $m_1:m_2:m_3$ , do not the same straight line relations.

These findings have been confirmed with the mercuricmercurous cell



That is, for a constant ratio  $m_1:m_2:m_3$ , the concept of mean activities, conjunction with the Debye-Huckel equations, give straight line functions. Different ratio,  $m_1:m_2:m_3$ , give different straight lines.

The above regularities have been interpreted to mean that the ionic species assumed to be present, are present and that for constant ratio, as given above, the stoichiometric concentration of the assumed ions is directly proportional to the total stoichiometric concentration of the respective salt.

It has been proposed that the straight line relations may be used to qualitatively test for chemical complexes and their state of ionization. This proposal has been used to show that in an aqueous solution which contains twice as much ceric sulfate as cerous sulfate and fifty times as much sulfuric acid as total cerium,  $Ce^{++++}$ ,  $Ce^{+++}$ ,  $H^+$ ,  $HSO_4^-$ ,  $SO_4^{--}$ , and  $Ce(SO_4)_3^-$  ions are present.

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Publication No. 992

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## MULTIMOLECULAR ADSORPTION FROM BINARY LIQUID SOLUTIONS

Robert S. Hansen, Thesis (Ph.D.)  
University of Michigan, 1948

Isotherms for the adsorptions of a series of organic compounds (propionic, n-butyric, n-valeric and n-caproic acids, n-propyl, n-butyl, and n-amyl alcohols, aniline, cyclohexanol and phenol) from aqueous solution by sugar charcoal and a series of graphites and carbon blacks of known specific surface areas were determined using an interferometric technique. Sigmoid type isotherms were obtained for the adsorptions of all slightly soluble organic compounds by the graphites and carbon blacks, while Langmuir type isotherms were obtained for the adsorption of the same compounds by sugar charcoal.

It is shown that the adsorption of slightly soluble organic compounds from aqueous solution by graphites and carbon blacks is multimolecular, i.e. that the adsorbed film is more than one molecule thick.

Multimolecular adsorption from binary liquid solution is found to be represented by the Brunauer-Emmett-Teller equation as well as the adsorption of gases for which this equation was derived. The constant in this equation corresponding to the limiting number of moles in a complete monolayer is roughly proportional to the specific surface area, but if interpreted in this manner indicates that a complete monolayer always contains appreciable quantities of solvent (water). The constant  $n$  in this equation corresponding to the limiting number of adsorption layers does not appear to have much physical significance according to the results obtained; reasons for this lack of significance are discussed.

For each adsorbent the isotherms for the adsorption of n-caproic and n-valeric acids from aqueous solution were found to be congruent functions of the reduced concentration (concentration divided by saturation concentration). The isotherms for the adsorption of aniline and phenol from aqueous solution were similarly congruent for sugar charcoal and carbon blacks but not for graphites. This behavior is explained in terms of oriented adsorption.

Isotherms for the adsorption of the completely soluble propionic and n-butyric acids from aqueous solution by graphites were not found to be sigmoid, but by means of a linear transformation of the concentration axis could be made to coincide with the isotherms for the adsorption of n-caproic and n-valeric acids up to the points of inflection of these latter isotherms, and were also represented by Brunauer-Emmett-Teller equations. Significance of the linear transformation of the concentration axis is discussed.

The Brunauer-Emmett-Teller theory of gas adsorption is criticized, and success of this theory is shown to indicate existence of forces due to the adsorbent beyond the first adsorption layer. These forces are considered to account for multimolecular adsorption both of condensable vapors and of slightly soluble compounds from liquid solution.

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Publication No. 1052

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THE MECHANISM OF ADSORPTION OF SOME  
DYESTUFF ANIONS ON SILVER HALIDES

Gretchen Bright Mueller, Thesis (Ph.D.)  
University of Michigan, 1940

The investigation was undertaken to determine whether dye adsorption on silver halide crystals occurs by exchange of the dye anion with the halide ion of the crystal surface, or whether the adsorbed dye ions are added to the silver ions at the surface of the lattice. The effect of excess silver ions in the solution on the adsorption of dyestuff anions can be used to distinguish between these two mechanisms.

The AgI adsorbent was prepared by precipitation in 27% ammonia solution by adding, dropwise, equivalent solutions of  $\text{AgNO}_3$  and KI. The AgBr was precipitated similarly in 5% ammonia. The precipitates were very thoroughly washed with hot water and were air dried. These preparations and the adsorption experiments were carried out in a dark room. Reproducible results were obtained with two preparations of each halide.

The dyes used were the purified sodium salts of chromotrope F4B, eosin, and erythrosin. The dyestuff concentrations were measured with a Nutting spectrophotometer before and after shaking with the adsorbent powder, and the amount adsorbed was calculated from the decrease in concentration, the volume of solution, and the weight of adsorbent used.

The displacement action of anions on the adsorbed chromotrope F4B was measured. On AgI the order is  $\text{I}^- > \text{CNS}^- > \text{Br}^- > \text{Cl}^-$ ; on AgBr it is  $\text{CNS}^- > \text{Br}^- > \text{Cl}^-$ .

The saturation adsorption values of chromotrope F4B, eosin, and erythrosin on AgBr without the addition of excess of silver or halide ions were in the ratio 1 : 8 : 64, which is qualitatively the gradation expected from the insolubility of the silver salts of the dyes. (The solubility of the silver



salt of chromotrope F4B was measured and found to be  $2.5 \times 10^{-3}$  mols per liter at  $25^{\circ}$  C.) With increased silver ion concentrations, the saturation values for eosin and chromotrope came closer together; because of the low solubility of silver erythrosinate, not enough silver ion could be used to show the effect with this dye. These results show that the number of centers active in adsorption on the equivalent body depends largely on the nature of the adsorbate, but as the surface becomes charged by the adsorption of excess lattice cations, the individual characteristics of the adsorbate become of less importance. Chromotrope, eosin, and erythrosin gave on AgI, without added silver ion, saturation adsorption values in the ratio 1 : 1 : 8.

The saturation adsorption of the dye anions, both on well aged AgBr and AgI and on freshly precipitated AgI becomes greater in the presence of excess  $\text{AgNO}_3$  in the solution. The effect of the silver ions increases with their concentration but limiting values of adsorption of the three dyes were approached at concentrations of  $\text{AgNO}_3$  below  $5 \times 10^{-4}$  M. This indicates that the number of active centers for anion adsorption increases with the amount of adsorbed silver ions, but that there is no further deposition of the silver salt of the dye when the surface becomes saturated with excess silver ions.

The fact that the saturation adsorption of the dye depends on whether an excess of  $\text{AgNO}_3$  is present or not is in disagreement with a mechanism of dye adsorption according to which the primary process consists in an exchange of the lattice anions on the surface of the adsorbent by the dye anions. The results support the mechanism applied to adsorption indicators by K. Fajans and associates according to which the adsorption occurs as an addition of the dye anions to silver ions on the surface. These may be either the silver ions normally present in the lattice surface or those adsorbed from an excess of  $\text{AgNO}_3$ .

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Publication No. 1066

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## THE SOLUBILITY OF INORGANIC COMPOUNDS AND POLARIZATION OF IONS

William M. Spurgeon, Thesis (Ph.D.)  
University of Michigan, 1942

In order to arrive at an understanding of the high solubility in benzene (0.25 mol/1000 g. benzene at 25°C) of silver perchlorate, a salt with pronounced ionic character, other silver salts and perchlorates have been tested for their solubility in benzene and other solvents have been used for silver perchlorate. Lithium, sodium, potassium, barium, lead and thallous perchlorates as well as silver fluoride and silver sulfate have been found to be practically insoluble in benzene. At 25°C the solubility of silver perchlorate in m-xylene is about three times, in ethyl benzene more than ten times larger than in benzene. This salt is very soluble in caprylene. The molality of the saturated solution in nitrobenzene is 0.037, in chlorobenzene 0.001 and the solubility is not appreciable in cyclohexane. The molar heat of solution of silver perchlorate has been found at 24°C to be +2.4 kcal(exothermic) in 160 moles of dry benzene and +3.8 kcal in 180 moles of water-saturated benzene.

The above data and the previously known properties of solutions of silver perchlorate suggest an explanation of its remarkable solubility in some organic solvents. Due to the small polarizability of the perchlorate ion and to its weak polarizing field, the state of the silver ion in the perchlorate is more like the free gaseous ion than in any other known anhydrous silver salt. Since the silver ion and other non-noble gas type cations of high polarizing power are known to exert attractive forces on molecules of unsaturated hydrocarbons, part of the solvation energy of silver perchlorate can be assumed to be due to the effect of its unscreened cation on the easily polarizable organic solvent molecules.



This special case of an interrelation between polarization properties of ions and the solubility problem revived interest in the effect of ionic polarization on the solubility of salts in water. It has been shown by K. Fajans, especially by comparing the properties of silver and sodium salts, that strong polarization effects tend to increase the lattice energy, to make the heat of solution more endothermic and the solubility smaller. These relations have been applied in the present thesis to compounds of other cations.

In the experimental part, the solubility of anhydrous ammonium fluoride in water has been found to increase linearly from 20.8 to 23.2 molal between 5.5° and 25°. Measurements of the molar heats of solution gave for thallous perchlorate in 398 moles of water -10.6 kcal (endothermic) at 24.4°, for thallous fluoride in 525 or 785 moles 0.00 kcal at 24.0°, for silver fluoride in 403 moles water 4.70 at 24.5°.

These results were used in conjunction with data from the literature to compare compounds of cations of noble gas type with those of non-noble gas type in respect to crystal structure, lattice distances, molar volumes, lattice energies, heats of solution and solubilities. The following pairs of ions were compared:  $\text{Rb}^+$  with  $\text{Tl}^+$ ;  $\text{Sr}^{2+}$  with  $\text{Pb}^{2+}$ ;  $\text{Zn}^{2+}$  and  $\text{Mn}^{2+}$  with  $\text{Mg}^{2+}$ ;  $\text{Cu}^{2+}$ ,  $\text{Cd}^{2+}$  and  $\text{Hg}^{2+}$  with  $\text{Ca}^{2+}$ . As in the case of the comparison of  $\text{Na}^+$  with  $\text{Ag}^+$ , the greater polarizing ability of the non-noble gas type cations shows up in many of these properties and especially in solubilities. The ratios of the solubilities of the compounds of noble gas type cations to those of the corresponding non-noble gas type ions increases enormously with increasing polarizability of the anions.

On the other hand the comparison of ammonium and rubidium salts supports the assumption of a polarization of  $\text{NH}_4^+$  in the strong field of the small anion  $\text{F}^-$ .

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Publication No. 1079

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## THE IODOMETRIC DETERMINATION OF CERTAIN PHENOLS

A. L. Wooten, Thesis (Ph.D.)

University of Michigan, 1948

This thesis may conveniently be divided into three parts.

The first part is the description of a volumetric method for the determination of resorcinol which is subject to few interferences. It has been found in this investigation that resorcinol may be quantitatively iodinated at a pH of 4.7-5.0. Most other phenolic substances are relatively slowly iodinated by iodine at this pH. The sample is buffered with an acetic acid - sodium acetate mixture at a pH of 5.0. An excess of 0.1 normal iodine is added. After a short iodination period the excess iodine is titrated with standard sodium thiosulfate and starch. No previous example of the selective iodination of one phenol in a mixture has been found.

The second part of this paper is a description of a colorimetric procedure suitable for the quantitative or qualitative estimation of meta dihydroxyphenols and of ortho dihydroxyphenols. This procedure is based on the formation of a blue-black precipitate which forms when iodine is added to a buffered solution containing both resorcinol and catechol. The excess iodine is destroyed with sodium thiosulfate.

Acetone is added to the sample so that the precipitate dissolves yielding a clear violet solution. This color reaction has been found to obey Beer's Law in the range 0-75 p.p.m. of unknown. Procedures are described for the determination of resorcinol, catechol and phloroglucinol. No previous mention of a colorbody of this type has been found in the literature.

The third and final part of this paper is the description of an analytical procedure suitable for the determination of certain ortho alkyl- and arylphenols. The action of iodine on the ortho isomers in a strongly alkaline solution produces dark colored polymeric precipitates known as aristols. The precipitate produced by the para isomers under these conditions is not colored. It is possible to extract these aristols with toluene, the color of which is then measured in the colorimeter. The ortho content is then estimated by comparison with a standardization curve.

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Publication No. 1085

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## CHEMISTRY, PHYSICAL

### APPARENT MOLAR REFRACTION AND VOLUME OF SALTS IN WATER, ETHER AND ACETONE SOLUTIONS

Oliver Johnson, Thesis (Ph.D.)  
University of Michigan, 1943

A refractometric study has been made of solutions of silver fluoride and potassium cyanate in water and also of anhydrous lithium salts in ether (perchlorate, bromide and iodide) and in acetone (perchlorate). The purpose has been to extend the study of mutual interactions of ions and molecules in solutions pursued in the series of "Refractometric Investigations" by K. Fajans and associates.

The necessary modifications in the standard techniques for precise measurement of density with a bicapillary pycnometer and of index of refraction with a Pulfrich refractometer are discussed for the case of aqueous silver fluoride solutions which are corrosive to glass, and for the case of solutions containing the volatile organic solvents, ether and acetone. Apparent molar refractions ( $R$ ) and volumes ( $\Phi$ ) are calculated from the experimental values of index of refraction and density for a series of solutions of accurately determined salt concentrations. The plot of  $R$  or  $\Phi$  against concentration enables one to obtain the values of  $R_0$  or  $\Phi_0$  by extrapolation to infinite dilution.

For aqueous silver fluoride the apparent molar refraction at infinite dilution was found to be 7.52 cc/mol which, compared with the  $R_0$  values of  $\text{AgNO}_3$ ,  $\text{KF}$  and  $\text{KNO}_3$ , fulfills the additivity relationship with an average uncertainty of 0.01cc for each salt. The increase in  $R$  with concentration  $C$  was 0.017 cc x mol<sup>-1</sup> x 1000 g. The apparent molar volume can be expressed by the equation,  $\Phi = -3.30 + 5.90 \sqrt{C}$ . The negative  $\Phi_0$  value (-3.30cc) shows that the electrostriction effect of  $\text{Ag}^+$  and  $\text{F}^-$  on water is among



the strongest known for singly charged ions; the large slope of the  $\Phi$  vs.  $\sqrt{C}$  curve (5.90) must be caused mainly by the removal of this electrostriction as the solution becomes more concentrated. The same effect is considered to be partly responsible for the large increase in  $R$  with concentration. Comparison with previous refractometric data on aqueous potassium fluoride solutions gives support to the existence of a loosening effect of  $F^-$  on the electronic system of the water molecules and of adjacent cations.

The value 9.9cc was obtained for the apparent ionic refraction of  $(OCN)^-$  in aqueous solution and has been compared with the refraction of other iso-electronic triatomic linear particles.

The value of  $R_0$  for lithium perchlorate was found to be 11.40 cc/mol in ether and 12.88 in acetone. The data for the apparent molar volume of  $LiClO_4$  can be represented by the equations:  $\Phi = 14.2 + 1.73 C$ , in ether;  $\Phi = 11.0 + 4.65 C$ , in acetone. The apparent molar refraction is 11.4 cc/mol for lithium bromide in a 1 molar ether solution, while  $R_0 = 16.2$  for lithium iodide in ether. The corresponding  $\Phi_0$  values are 10.0 and 8.0 cc/mol respectively.

The relatively small values of the apparent molar volume and refraction of  $LiClO_4$  in ether, as compared with Geffcken's data for aqueous solutions, must be due to the very strong interaction between the  $LiClO_4$  molecule and ether as well as between adjacent ether molecules surrounding a  $LiClO_4$  molecule. The strong electrical field of the lithium ion is not effectively screened by the rigid  $ClO_4^-$  ion. Strong intramolecular interactions between the ions of  $LiBr$  and  $LiI$  and between those molecules and the solvent are indicated by the properties of their ether solutions.

The present data, obtained by the application of precise refractometric methods to salt solutions in solvents other than water, show that a refractometric study of such systems offers promise for elucidating the nature of electrical interactions in solutions.

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Publication No. 1058

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## ECONOMICS

### LEGISLATION AGAINST DISCRIMINATION IN EMPLOYMENT IN NEW YORK STATE

A Study of the Historical Antecedents, from 1609 to 1945, of Attempts to Direct and Influence Change through Legislation as it Relates to Racial and Religious Discrimination in Employment.

Marguerite Cartwright, Thesis (Ed.D.)  
New York University, 1948

This study is based on standard historical works plus the author's participation in the myriad activities which in New York State led to the passage of the Ives-Quinn bill. The relevant historical and social factors are analyzed in terms of their immediate and long term significance to the primary American ideal of equality of opportunity. This is a component part of a democratic way of life and implies a relatively fluid social structure which changes from generation to generation. The problem of inter-group relations is a continuing one met by each generation in a new form and setting. Therefore, the endless efforts to understand, adapt and control must be viewed from changing perspectives.

It becomes necessary to utilize modern legislative techniques and continually improve the mechanics of social organization. A heightened responsibility of the individual to his society and a reaffirmation of values and principles are indispensable to the maintenance and furtherance of a democracy, the preservation of which today appears necessary to peace and possibly to the existence of civilization itself.

On the hypothesis that legislation cannot take place in a vacuum, the total political and social



experience is examined. The causes for change are sought in the progressive acceleration of society itself.

Legislation is conceived as one method of adaptation to change. The use of law in a democratic framework to maintain social order without loss of freedom calls for an examination of how laws come about and how they derive their powers. The efforts to solve the complex problem of inter-group living must not be allowed to create greater problems nor produce a series of unintended consequences.

Due to a combination of factors New York early assumed a position of economic, social and political leadership. The effort to translate abstract formulae for social justice into concrete action often proved to be a sound interpretation of the public will. Progress was uneven as some laws were proposed in an unhealthy social milieu but progressive legislation was successfully pushed forward when it was expedient and when there was social readiness.

In New York State the social ferment was often nurtured by the group of politically conscious and articulate Negroes aided by their white friends.

As a result of proposals made by the Governor's commission to study New York's colored population, the Constitutional Convention of 1938 included a provision in the Bill of Rights of immense importance and widest implication. The right to work was held to be a civil right and thus New York was uniquely prepared to approach the final task of outlawing discrimination in employment.

The Second World War transformed American life and touched on every phase of existence. Racial harmony became a matter of national concern and possibly a condition of survival. Yet, although the minority problem was related to the stated ideological moral principles of the war there was still limited employment opportunity for minorities, especially Negroes. As a result there was mass protest including a threatened "March on Washington." The latter



was abandoned only on the promulgation of an Executive Order that fair employment must prevail in war industries. The Fair Employment Practices Committee as it became known, was a wartime phenomenon which grew out of the urgent need for increased manpower, and a war inspired democratic climate of public opinion. The F.E.P.C. was discontinued with the end of the war, but it was of great significance as a declaration of national morality. Public policy had been established in the realm of non-discriminatory hiring and the issue was raised to the level of state concern. It pointed the way, refreshed democratic traditions, and strengthened beliefs.

About this time several official and voluntary citizens' committees appeared all over the country for the purpose of lessening inter-group tensions. Leading citizens signified their willingness to work in the interest of unity and tolerance and lent their prestige and support.

In New York State Governor Dewey directed that the Commission on Discrimination concern itself with economic and social problems as well as: 1) to propose methods for promoting public support of non-discrimination in employment; 2) to enforce existing laws more effectively; and 3) to recommend the additional legislation deemed necessary.

A commission was set up and sample legislation was written. Hearings were held throughout the State to which the public was invited. This plan to invite the public to help write and pass on a law was revolutionary. Hundreds of earnest citizens accepted the invitation and came to express opinions and offer suggestions. Sentiment in favor of the legislation outweighed that opposed about six to one.

The final bill incorporated many of the suggestions which had been made. The right to employment irrespective of race, creed, or color was now protected by law. It was passed by the Legislature and signed by Governor Dewey on March 12, 1945.

The measure was in one sense a natural outgrowth of the continuing social effort in New York State to

preserve the human values implicit in the democratic ideal. It reenforced existing statutes and implemented ideals of social cooperation. New York's potentiality for this further extension of civil rights had been accurately appraised.

However, the law is by no means a finished tool nor an end in itself. It cannot be fully effective without spiritual and moral discipline and the sober resolve of the people to measure up to the obligations it imposes.

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Publication No. 981

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## AN ECONOMIC ANALYSIS OF TURKEY'S FOREIGN TRADE AND TRADE POLICIES IN AGRICULTURAL PRODUCTS

Ismail H. Sener, Thesis (Ph.D.)  
Michigan State College, 1948

Turkey is predominantly an agricultural country with 75 per cent of its population gainfully engaged in agricultural production. About 58 per cent of the national income is derived from agriculture, while over 85 per cent of the export trade is composed of agricultural products.

Turkey's industrial development has been carried on according to definite 5-year plans under the supervision of the government. More than 50 per cent of the industries are owned and operated by the state. The textile industry has developed most rapidly.

Turkey's products entering in international trade are primarily specialized agricultural products. The principal export products are tobacco, filberts, raisins, figs, cotton, mohair wool, opium and chrome ore. Very few agricultural products are imported. The principal imports are industrial goods, namely iron and steel products, machines, motor vehicles, chemicals and textiles.

In her foreign trade Turkey has been very dependent on Europe, notably the Western and Central European countries. Prior to World War II over 80 per cent of Turkey's total trade was carried on with European countries.

Turkey's economic policy was born of a strong reaction against the conditions under the Ottoman regime. Modern Turkey has attempted to develop her economy as an integrated whole. To this end, Turkey chose the policy of economic nationalism, involving considerable self-sufficiency. Turkey has had a trade policy which was strictly controlled. The trade control measures were designed to stimulate



exports while restricting imports. In Turkey's trade policies tariff duties have been a major trade barrier. With the exception of agricultural machines and supplies, practically all merchandise imported is subject to high tariffs. Import quotas, import licensing, import monopolies and exchange control measures were other trade barriers adopted during the thirties. The principal objectives of these measures were to maintain a certain degree of stability in the value of Turkish currency, to protect local industries, and, more particularly, to bring about an excess of exports over imports; thereby permitting the repayment of the country's foreign debt.

From 1934 to 1940 the above measures were supplemented by bilateral trade agreements and a compensation system of trade. These measures made it almost impossible for Turkey to trade according to the principle of comparative advantage.

Prior to the war, Turkey's sole reduction in trade barriers was a reciprocal trade agreement with the United States.

It must be recognized that Turkey's policy of expanding industrialization meant less difficulties during the recent war than if she had been solely an agricultural nation as in the twenties. At a time when other countries had few goods to export, Turkey was able to produce part of her necessities. Thus over the period 1923-47, Turkey has had positive gains and positive losses from her controls over trade. The pattern for the future will depend on developments in international negotiations especially in trade practices of other parts of Europe. They will be reflected in Turkey's trade policies since Turkey as a small trading nation finds it difficult to pursue an independent trade policy.

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A CRITIQUE OF POLICIES FOR RECONSTRUCTING  
INDIA'S RURAL ECONOMY

Jaswant Singh, Thesis (Ph. D. )  
Michigan State College 1948

India, once rich and prosperous, today suffers from grinding poverty. Until August 1947 the Britishers, rightly or wrongly, had to bear the brunt of the blame for this situation. But now it is up to the people of India to lift themselves from the slough of degrading poverty. The leaders realize this and are already advocating drastic reforms in the economy. Although it is highly desirable to improve the standard of living of India's 400 million people in the shortest possible time, it is necessary to be very careful about the means used to achieve the objective.

Since 87 per cent of the people of India live in the villages, the problems of poverty and their solution lie in the rural economy. Past efforts to improve the situation have failed largely because they did not strike at the root of the matter. To achieve really significant and lasting results it seems imperative to correct the basic weaknesses of the economy.

The weaknesses are, (a) lack of general education, (b) pressure of population increase, (c) lack of industries, (d) poor land utilization, and (e) low fluctuating returns.

Education being the basic condition for all reform, it seems necessary to begin it in the form of a crusade. For a few years it may be necessary to draft graduates and undergraduates to provide needed teachers. More emphasis needs to be given to female education. Moreover, an adequate agricultural extension service needs to be organized to impart specialized education in farming and homemaking.



A similar crusade for birth control appears to be the only way to check the startling increase of population. Birth control clinics should be established wherever possible. In addition, prohibition of polygyny, encouragement to urbanization and introduction of compulsory education and social security provisions should prove useful in reducing the birth rate.

To relieve population pressure on land, a high degree of industrialization is necessary. Ruralization of industry, however, seems to be a short-sighted policy. Rural industry is apt to be inefficient and so will not be able to stand the competition of large-scale plants. Nor will it relieve over-crowding in rural areas. However, to prevent business depressions and evils of monopoly, the urban industrial development will have to be carefully guided by a central non-governmental commission.

To remove the inefficiencies of the uneconomic holdings and systems of land tenure more fundamental changes seem to be necessary. But before making changes it is desirable that all such proposals as collectives, joint farming, cooperative cultivation, and managerial farming be tried to find out their suitability under Indian conditions. The change in law of inheritance to prevent subdivision of holdings, while desirable, does not seem to be feasible in the absence of suitable openings for the dispossessed heirs. Moreover, before it is done we should know the system of farming to be adopted.

To stabilize the returns of the peasants, crop insurance is needed in the areas particularly susceptible to natural hazards. Improvements in marketing through better diffusion of price information, grading by impartial agencies and provision of warehouse facilities should reduce marketing margins. Stabilization of prices through support or forward price programs offers less opportunity. Simultaneously there is need of an efficient credit system. But to be really useful it must be accompanied by advice



regarding its proper use. Changes in the land tax to provide exemption to incomes below a minimum and progression in higher brackets are necessary to make it more equitable.

The changes suggested, though aimed at removing basic weaknesses of the economy, are not designed to be revolutionary. For history shows that revolutionary changes seldom achieve their purpose.

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Library of Congress Card Number Mic A48-134

## THE CONSUMPTION FUNCTION

### A Study of Relations between Income and Consumer Expenditure

James S. Duesenberry, Thesis (Ph.D)  
University of Michigan, 1948

The Consumption Function is defined as the relation between aggregate Disposable Income per unit of time and aggregate Consumer Expenditure per unit of time. Keynes originally maintained that Consumer Expenditure is a function of aggregate income and that this function is stable over fairly long periods of time. A number of writers have attempted to determine the characteristics of this function by empirical studies of aggregate economic data. The results are ambiguous in the sense that several different functions are consistent with the data. It is argued that correlation tests of aggregate hypotheses are inadequate because of the interrelations among the aggregates. Satisfactory tests require the use of micro economic data such as those obtainable from budget studies.

Available data prove the following general propositions about the co variation of income and consumption.

- (1) Over the past seventy-five years income and consumption have risen in roughly the same proportion.
- (2) Over the trade cycle variations in consumption are less than proportional to variations in income.
- (3) When individual budgets covering the same period are compared consumption rises with income but less than proportionately.

An adequate theory of consumption must explain all three of these sets of facts. In current formulations the short and long period data are brought into consistency by introducing an upward trend in consumption. However, it is shown that the factors supposed to underlie the trend are not very powerful and are offset by some other factors which might be



expected to produce a downward trend in consumption.

The budget study data are roughly consistent with the cyclical data if three assumptions are made:

- (1) The size distribution of income is approximately constant over the cycle.
- (2) Consumer Expenditures at one time are independent of expenditures in the past.
- (3) The Consumption Expenditures of one individual are independent of the expenditures of other individuals.

In this dissertation, assumption (1) appears to be correct but it can be shown that it is most improbable that the other two assumptions are true. Assumption (2) is replaced by the assumption that in the trough of the cycle consumption expenditure depends on the ratio, current income/previous peak income. This hypothesis is supported by data from budget studies.

Assumption (3) is replaced by the assumption that, in the long run, the proportion of income spent on consumption by one individual depends on the ratio of his income to a weighted average of the incomes of others. This implies that aggregate consumption tends to vary in proportion to income provided that the income distribution is constant. This hypothesis is supported by an argument based on psychological and sociological considerations.

When both hypotheses are considered together we obtain the equation  $\frac{S_t}{Y_t} = a \frac{Y_t}{Y_o} + b$ . ( $S_t$  = current real

saving per capita,  $Y_t$  = current real disposable income per capita,  $Y_o$  = highest previous value of real disposable income per capita)

The values of  $a$  and  $b$  are estimated at  $a = 249$ ,  $b = -196$  from data covering the period 1929-1941. The equation fits the short period data very well and at the same time it is consistent with the long period data. The argument on which the equation was based explains the relation between the budget study data and the aggregate data.

Publication No. 1043

Microfilm copy of complete manuscript 250 pages  
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## THE DEVELOPMENT OF CALIFORNIA AS A MANUFACTURING AND MARKETING CENTER FOR FASHION APPAREL

Charles S. Goodman, Thesis (Ph.D.)  
University of Michigan, 1948

In recent years, the growth of Los Angeles, San Francisco, Dallas, and St. Louis as production and marketing areas for certain types of ready-to-wear has received considerable attention. While New York is still the major source of supply for all types of ready-to-wear, the Los Angeles market center in particular has attained sufficient importance as a resource that the more important retailers generally feel a need for shopping that market in addition to the one in New York for many lines of merchandise. This trend covers too long a period to be attributable primarily to wartime conditions.

The objective of the present study is to examine the California apparel industries in order to determine the factors which have brought about the development of a new market center attracting buyers on a nation-wide basis yet remote from the existing wholesale market.

The study opens with a discussion of the nature of fashion and the major role which it plays in determining the structure and location of the apparel industries. A concept of use-fashions, as distinct from the design-fashions customarily referred to by writers on fashion, is introduced and related to the development of different apparel producing and marketing centers. The second chapter examines the growth of the apparel industries in the United States and summarizes their salient characteristics. The apparel manufacturing and marketing institutions now established in California, the products manufactured, and the ultimate disposition of those products are discussed in Chapter III and are compared with



apparel manufacturing elsewhere. Chapter IV presents a summary of locational trends in apparel production including tables showing the relative importance of the leading producing centers since 1889. The growth of the California industry in size and importance is then treated in some detail both from a production and a marketing point of view.

Chapter V introduces the general reasons for shifts in markets for fashion merchandise and presents a detailed analysis of the position of California producers in respect to the more important costs of production and other causal factors such as the relative costs of transportation, the production atmosphere, and changes in social patterns. The basic force underlying the development of the California apparel market has been the change in use-fashions towards the more frequent use of sportswear and less formal wear in general. There has been not only a growth in new uses of less formal garments arising out of increased sport activities but also a noticeable increase on the whole in informality of attire.

California, because of its climate, topography, and uninhibited population, led in the early adoption of less formal attire for a wide variety of occasions. The long and sunny dry season and the varied topography of the mountains, desert, and sea fostered widespread development of outdoor activities. These natural attributes, combined with a relative freedom from the restraining hold of custom which is likely to characterize areas of immigration, brought about a demand for more comfort and utility in apparel. This need was satisfied by the development of a local apparel industry. This industry, in catering to local tastes, employed a considerable degree of originality in design and developed a product based on utility and comfort and noted for its wide use of color. When the more extensive use of casual apparel spread to other areas, the California apparel industry had already achieved the advantages of experience in the design and the use of color in less formal garments. It was thus in a position to become a leader.

In California, certain natural and created advantages for apparel design and manufacture have supplemented these basic forces. In addition, war-born conditions have accelerated the development of the California apparel market.

In Chapter VI, locational developments in apparel manufacture and wholesale markets in the United States are examined in terms of locational theory and an attempt is made to determine the adequacy of locational theory in explaining the observed changes.

The report includes forty-seven tables, a glossary, and a bibliography.

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Publication No. 1049

Microfilm copy of complete manuscript 229 pages  
at 1 1/4 cents, total cost \$2.86, paper  
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Library of Congress Card Number Mic A48-148



## NATIONAL MINIMUM WAGE REGULATION IN THE UNITED STATES

Irving Isadore Paster, Thesis (Ph.D.)  
University of Michigan, 1948

The purpose of the study is to analyze the economic significance of minimum wage regulation especially with reference to the Fair Labor Standards Act of 1938. The examination of minimum wage controls other than those in this Act is largely incidental as is the review of complementary social controls such as hours and child labor regulation with which the legal minimum wage is frequently allied. The study is also limited to the analysis of the regulation of the wages of low-paid workers as contrasted with all grades of labor.

The theoretical portion of the study deals with wage theory with special emphasis on the theory of legal minimum wage regulation. The historical portion covers regulation in Australasia, Great Britain, and Canada as well as state and federal regulation in the United States prior to 1938. The major portion of the study, however, is devoted to the Fair Labor Standards Act of 1938.

The legislative struggle which preceded the passage of the latter Act is reviewed as is the question of the Act's constitutionality. The scope of the Act's coverage and the numerous and complicated exemptions which pervade it are examined. The problems inherent in coverage together with the various proposals suggested for their solution are explored. The effects of the enactment of the Portal-to-Portal Act on enforcement are noted. The study concludes with an examination of the economic effects attributed to the Act.



The history and growth of minimum wage regulation by government point to the expansion of such control with the growth of the economy and with the continued acceptance of a philosophy of government intervention in areas where private enterprise fails to function in the best interests of the economy. The most important minimum wage law in the United States, the Fair Labor Standards Act of 1938, is structurally deficient but, nevertheless, it has been of great value because of its intelligent administration and because of its liberal interpretation by the Supreme Court. The economic effects of this Act are difficult to determine because of the inflationary effects of the war but so far as they can be determined, they have been beneficial to the economy. Yet, no matter how beneficial the Act may have been, other devices such as the guaranteed wage and an expanded social security system are necessary to solve the problem of poverty.

The minimum wage provided for in the Act should be increased and its coverage expanded. The statute of limitations on employee suits should be increased. The Act should be amended so that it could be used more frequently in connection with collective bargaining agreements calling for employment for periods approximating a year. Finally, the Act's provisions should be integrated with other federal laws related to labor standards.

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Publication No. 1071

Microfilm copy of complete manuscript 377 pages  
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Library of Congress Card Number Mic A48-170



## EDUCATION

### A TEACHING GUIDE FOR SPEECH IN THE ELEMENTARY CURRICULUM

(Intermediate-Upper Grades)

Louise Abney, Thesis (Ed.D.)  
New York University, 1947

#### Basis of the Study

A TEACHING GUIDE FOR SPEECH IN THE ELEMENTARY CURRICULUM is a teachers' manual, prepared for use by the classroom teacher in grades IV, V, and VI of the elementary school as an effective guide to speech education for every child.

The study has been based upon wide reading in the literature of speech education; a survey of the existing status of speech in the elementary school; conferences with outstanding authorities in speech, elementary education, and curriculum; and an understanding of the growth and maturation of the child, developed through reading, observation, and analysis of pupil-interests.

A survey of the existing status of speech in the elementary school was made in several ways: (a) consideration of numerous courses of study for the purpose of ascertaining whether, and where, oral activities are operative or feasible; (b) reports from classroom teachers under the candidate's instruction in teachers colleges; (c) observation and supervision in the elementary schools of Kansas City, Missouri, over a period of fourteen years; and (d) personal visits in the interest of speech education to many public school systems in cities of the United States.

#### Significance of the Study

The study is deemed significant because of the current emphasis upon oral expression in our contemporary society and the obvious need of more effective communication; because of the interest of both pupils.



and teachers in constructive techniques in speech; and because of a serious limitation in material for the development of an integrated speech program in the intermediate-upper grades.

Since children form their speech patterns early, early guidance in the building of good speech prevents the need of speech re-education later. The prevention of speech disorders before correction is needed is psychologically sound and educationally economical. It may be further said that the developmental approach used by the classroom teacher for the benefit of every child rather than the selected few, is democratic in principle and practice. Such a program is closely related to the life-activities of the child in his every-day experience with conversation, reading, discussion, and other forms of communicative expression.

#### Speech, an Integrating Force

This study has been developed from the point of view of integration. Speech is presented in its relationship to broad fields of learning: the language arts, the social studies, and the fine arts. Informational material for the teacher includes a consideration of various types of curricular organization, the relation of speech education and the broad fields; information regarding voice, articulation, pronunciation; a listing of activities in which oral skills are needed; and suggested techniques and materials for the development of more effective communication for the child. Criteria to aid in the evaluation of pupil-progress are offered. A selective bibliography, purposely limited to books of greatest practical value is included.

Throughout the study, speech is viewed as a tool of communication which should be developed to such a point as to make social adjustment simpler, cooperative action easier, and cultural living richer. In that speech is a common medium and important factor in every type of curricular organization, the development of adequate oral techniques is urged as the demo-



cratic, educational right of every child, in order that he may be a well-integrated, effective, happy individual expressing himself easily and well in oral situations.

### Material

Instructional material in this study includes quotations relevant to good speech, charts for the analysis of speech patterns, information as to the formation of the sounds in our American speech, presentation of diacritical markings as given by Webster and the International Phonetic Alphabet, analysis of types of error frequently heard in pronunciation, techniques for the guidance of discussional activities; games, plays, radio scripts, and other selections for oral reading.

The value of the study will depend upon the use which is made of it by the classroom teachers for whom it was written. Its use, in turn, will find its value in terms of more effective individuals in the communication area: girls and boys in our American schools speaking well.

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Publication No. 975

Microfilm copy of complete manuscript 243 pages  
at 1 1/4 cents, total cost \$3.04, paper  
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Library of Congress Card Number Mic A48-113

## FIELD SERVICES OF THE NEW YORK STATE TEACHERS COLLEGES TO THEIR SERVICE AREAS

Michael S. Auleta, Thesis (Ed.D.)  
New York University, 1947

The major objective of this study is to set up the basis for the organization of a field service program to be sponsored by the state teachers colleges of New York. The following significant questions are answered insofar as they relate to the major objective:

1. In what areas of service can teachers colleges be of assistance to public school personnel in the field?
2. What types of services are now rendered by the New York state teachers colleges to their service areas?
3. How are these services appraised by the schools and communities in the service area?
4. How do these services compare with those rendered by other teachers colleges and with standards proposed by authorities?
5. What services do the communities want from the teachers colleges?
6. What are the problems confronting beginning teachers in-service and how can the colleges assist them?

The idea of a teachers college occupying the role of a regional service center to which public school personnel in-service and the public in the neighboring communities can appeal for services of a professional, vocational, or cultural nature is a comparatively recent one. Studies conducted throughout the nation as well as studies made in New York State reveal the need for some form of organized professional assistance to schools and communities in the areas served by the colleges.



A questionnaire survey was made of the field services offered by the New York state teachers colleges located in Fredonia, Brockport, Cortland, Plattsburgh, Potsdam, Geneseo, Oswego, Oneonta, and New Paltz. The data compiled revealed little evidence of any organized, uniform, or effective program of field services for which the nine teachers colleges assume direct institutional responsibility. Placement service is the only activity regularly offered by all of the colleges. However, some provisions are made for services requested by graduates, public school personnel, and the lay public. Service available upon request include the following; library services, laboratory school observation, consultation with college staff members, educational clinics, personal visits in connection with follow-up service, guidance in personal adjustment to the community, extension course, teachers conferences, speakers bureau, and school assembly programs.

The administrative officers who represented the New York state teachers colleges recommended that the field service program should include the following four types of services; (1) placement bureau, (2) follow-up or adjustment service, (3) extension courses, (4) educational clinics. It was further recommended that all services except those connected with the library and laboratory school should be directed and coordinated by the field service department.

The needs of teachers and public school administrative officers were treated as factors in the organization of the proposed field service program. This phase of the investigation was focused on the area served by the State Teachers College at Brockport. Public school administrative officers and 1946 Brockport graduates expressed their reactions to the proposed program through the medium of questionnaires. Data revealed that graduates and administrators concurred on the value of the field services that might be made available to them. Graduates believed that round table conferences would be of most value to them, while personal visits by



college staff members would be of least value. This order was reversed according to the opinions expressed by the administrators.

The last phase of this investigation is concerned with that type of college field service which reaches out to members of the communities who are not teachers or administrators. A public opinion survey was conducted in the Brockport area for the purpose of obtaining a sampling of the public's reactions to the issues pertinent to this study. This part of the survey consisted of personal interviews followed up by questionnaires sent through the mail. The respondents who participated in this phase of the investigation approved the idea of a teachers college field service program. They indicated an interest in learning more about the work the teachers colleges are doing. They also recommended that a teachers college should extend its program to include the following services; adult education courses, community discussion forums, services of speakers, and radio programs.

A teachers college field service program was finally proposed in the light of the findings revealed in this study. This program includes; aims and purposes, activities, personnel and its responsibilities.

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Publication No. 976

Microfilm copy of complete manuscript 160 pages  
at 1 1/4 cents, total cost \$2.00, paper  
enlargements 6" x 8", at 10¢ per page. Available  
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Library of Congress Card Number Mic A48-114



## THE USE OF RADIO AND SOUND EQUIPMENT IN SECONDARY SCHOOL INSTRUCTION

### A Handbook for the Guidance of Secondary School Teachers in the Use of Radio and Sound Equipment in Classroom Instruction

Paul Sumner Nickerson, Thesis (Ed.D.)  
New York University, 1947

The problem involved is the production of a handbook which will serve as a practical guide to the effective use of radio and sound equipment as instructional aids in secondary education.

It presents its materials in four clearly defined fields, which with the exception of script writing, are defined by the nature of the audio material available for instructional use. These fields are: Student Listening, Script Writing, Broadcasting and Recording.

The audio equipment discussed comprises the radio, the public address system, the record player and the recorder.

There is need for this handbook. No single "tool book" exists which provides to teachers adequate instruction and guidance in the four basic fields treated in this handbook. Magazine articles are scattered; pamphlets are sometimes out of print, and both are necessarily limited in scope and content.

The procedures of this project, necessarily determined by its particular nature, are as follows: (1) personal experience and experimentation in the fields discussed in this book; (2) analysis of the broad field of audio aids into essential areas suitable for clear, coherent treatment in book form; (3) determination of general organization, methods of exposition, and style of presentation.



"Why Use Radio and Sound Equipment?" is the first subject considered. Ways are shown in which these audio aids can enable the teacher to accomplish essential aims by means of new, varied, or better procedures. Specific examples of utilization are provided in several subject matter fields and in the field of general education.

"Student Listening" is the second general subject discussed. Two basic areas of student listening are defined: Listening to Learn, and Learning to Listen.

The phrase, Listening to Learn, implies the use of radio and recordings as a means of acquiring knowledge and of developing attitudes. Such student listening may be employed as (1) initiating motivation, (2) one of the co-equal intermediate steps, or (3) a climactic culmination. Practical listening methods and procedures are defined. Examples of utilization are presented.

Learning to listen has as its aim to form in students the habit of listening to good radio programs. This aim is shown to imply growth in listening discrimination and taste. Four fundamental teaching steps to this end are discussed: (1) diagnosis of present listening tastes and habits of students; (2) guided listening experiences; (3) appraisal of changes in students' tastes and habits; (4) further work as shown necessary. Script writing is the third major subject discussed. Prepared scripts may be used for student broadcasting, but such valuable creative and functional benefits accrue to students from writing their own scripts, that student script writing is a most beneficial procedure. The particular nature of radio as a form of expression for "blind" listeners is shown to require the script writer to employ five special "techniques": announcer; radio dialogue; scene transitions; music and sound effects; and radio perspective. He must also use two basic "principles" - clarity, and vividness. Specific examples abound. Instructions are given for preparing scripts for newscasts, quiz programs, talks and discussion programs, and for adapting



prose, fiction, and drama for radio presentation.

Student broadcasting constitutes the fourth subject to be treated. The purpose is to provide educators with sufficient practical knowledge of the factors involved in directing and in producing amateur radio programs to enable them (1) to cooperate with a professional radio studio, and (2) to direct and produce school radio programs over a public address system. The necessary information on selecting a cast, "miking", directing participants, using sound effects, and actually operating the public address system is provided.

The final chapter explains the nature of recording equipment, and shows in detail how to use it effectively. It discusses such topics as: what the essential parts of a recorder are, and how they function; amplifier volume and tone quality, and how they are related to the cutting process; how to eliminate feedback; how to avoid overcutting and undercutting a record; how the actual recording process is conducted; and how the recording is played back.

The basic concept underlying this handbook is that radio and sound equipment can help teachers and students to achieve their purposes. Concrete suggestions for use of these audio aids, and specific instructions as to what to do and how to do it, constitute the body of the handbook.

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Publication No. 978

Microfilm copy of complete manuscript 393 pages  
at 1 1/4 cents, total cost \$4.92, paper  
enlargements 6" x 8", at 10¢ per page. Available  
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Library of Congress Card Number Mic A48-116

A STUDY OF THE PRACTICES IN TEACHING  
FIRST-YEAR ACCOUNTING IN THE TEACHER-TRAINING  
INSTITUTIONS OF ILLINOIS

Julius M. Robinson, Thesis (Ed.D.)  
New York University, 1947

The Problem

The problem of this study was to determine current practices in the teaching of elementary accounting in the higher institutions of Illinois with a view toward improving:

1. The teaching of elementary accounting in the colleges and universities.
2. The preparation of bookkeeping teachers for the secondary schools.

Procedure Followed in Conducting Investigation

The procedure followed in conducting the investigation was as follows:

1. An interview guide was formulated on the basis of extensive readings and the experience of the investigator. The guide was revised in accordance with recommendations submitted by a selected jury.
2. A list of questions pertaining to information desired was mailed to the respondents for their review.
3. At the time of the interview, the purpose of the study was explained and assurance given that the data furnished would be identified only in group findings before the interview was started.
4. As a result of this procedure, interviews were made in the twenty-five higher institutions which teach elementary accounting in the state of Illinois.



### Instruments of Research

The instruments of research used to present and interpret the data are as follows:

1. The case-study analysis was partially used to present the data for each institution and the survey analysis was used to present the variations of practices among the institutions.
2. The data were interpreted in the light of criteria considered to be valid.

### Summaries, Conclusions, and Recommendations

The data are summarized for the convenience of drawing conclusions and making recommendations.

#### Objectives of First-Year Accounting

##### Summaries

1. Sixty-six per cent of the students are taking first-year accounting as a basic course for managerial occupations, other business occupations, and the teaching of bookkeeping.
2. Approximately 33 per cent of the students who take the first-year course continue with the study of higher accounting.
3. Seventy-two per cent of the institutions have "the providing of a background in business knowledge which will help the students in other business courses and occupations" as their first-place objective.

##### Conclusion

The practice of making the "training of bookkeeping teachers" a secondary objective in 88 per cent of the institutions is not conducive to the training of well-qualified bookkeeping teachers for the secondary schools.

##### Recommendation

Higher institutions should not try to attain so many objectives in the first-year accounting course.

### Selection of Students

#### Summary

Selective devices to determine students' probable success or failure in accounting are not used by any of the institutions.

#### Conclusion

Too many students are dropping or failing the first-year accounting course.

#### Recommendation

Students should be selected for elementary accounting on the basis of aptitude, interest, and arithmetical ability.

### Exemption from Elementary Accounting

#### Summary

Only 36 per cent of the institutions had any form of exemption from elementary accounting for the students who had had bookkeeping in high school.

#### Conclusion

Students with previous training or experience in bookkeeping should not be placed in the same class with the beginners and forced to repeat what they had in high school.

#### Recommendation

Students who have had previous training or experience in bookkeeping should be given a qualifying test prior to enrolling in elementary accounting.

### Content of Course

#### Summaries

1. The content of the course consists largely of what is found in the text book.
2. Payroll deductions were taught in only eight institutions.
3. The number of practice sets used by the schools studied ranged from none to five. The average number used in first-year accounting was two.



4. Bookkeeping and accounting practices and procedures used in business firms were not taught extensively by any of the institutions.

#### Conclusions

1. The content of the elementary accounting course should be made practical. The accounting instructor should go beyond the textbook used to obtain from community resources practical exercise materials that are within the immediate interest and experience of the students.
2. One or two practice sets can be used to good advantage in teaching first-year accounting.

#### Recommendation

The teaching of elementary accounting should be brought from the strictly theoretical or textbook teaching to the practical by supplementing the textbook with practical accounting and bookkeeping procedures which are used in business firms of the local community.

#### Methods of Instruction

#### Summaries

1. The balance sheet and equation approaches are used most frequently by the elementary accounting instructors.
2. A combination of lecture and discussion is employed in presenting the subject matter to the students by the majority of the instructors.
3. The blackboard is used as a teaching aid by all of the institutions included in the study. No other visual aid is used extensively.
4. Work experience for the students is not provided by any of the institutions.

#### Conclusions

1. The accounting approach used by a particular textbook is not so important as long as the

- instructor makes use of the background experiences of the students.
2. Methods of instruction in first-year accounting for prospective bookkeeping teachers are most effective when patterned after proper methods of presenting bookkeeping in high school.
  3. The method of instruction used should call for a maximum of student participation and a minimum of lecturing by the instructor.
  4. Supplementing the textbook with practical bookkeeping procedures from local business firms is the best method of teaching students how to apply bookkeeping principles to actual business situations.

#### Recommendations

1. A combination of class discussion, teacher demonstration, and supervised laboratory should be used in presenting subject matter to first-year accounting students.
2. The accounting instructor should act as a discussion leader and as an assistant rather than as a lecturer.
3. A special effort should be made to provide students, preparing to teach bookkeeping in high school, opportunities to contact business firms and study bookkeeping practices and procedures while in college.

#### Evaluation of Student Progress

#### Summary

The factors used and the average weight given to determine the final marks in elementary accounting are: (1) daily problems, 23 per cent; (2) practice sets, 9 per cent; (3) tests, 52 per cent; and (4) final examination, 16 per cent.

#### Conclusion

1. An evaluation of the students' progress should not be based on the final examination alone.



2. Short tests should be given over each chapter.
3. Daily problems should be checked thoroughly but not graded.
4. Practice sets should not be used as a testing device.

#### Recommendation

The basis for evaluating student progress in first-year accounting should approximate the following: (1) tests (based on employment standards), 60 per cent; (2) daily work, 20 per cent; and (3) final examination, 20 per cent.

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Publication No. 979

Microfilm copy of complete manuscript 215 pages at 1 1/4 cents, total cost \$269, paper enlargements 6" x 8", at 10¢ per page. Available from University Microfilms, Ann Arbor, Mich.  
Library of Congress Card Number Mic A48-117

A COMPARATIVE STUDY OF LIBERAL AND CONSERVATIVE  
PHILOSOPHIES OF THE SOCIAL STUDIES  
IN HIGHER EDUCATION

Norma Harvester, Thesis (Ph.D.)  
New York University, 1948

An intrinsic interest in educational philosophy at the college level was the motivating impulse for this doctoral dissertation. The study defines two distinct philosophic approaches of the social disciplines and in terms of their existence in two specific college programs, compares and evaluates the two positions.

There may be said to be two poles in educational philosophy today, representing two approaches to the social sciences. At one end of the pole is the liberal approach which recognizes problems of contemporary life as being a serious and legitimate source of study, and utilizes several types of experience as a basis for learning. At the other end of the pole is the conservative approach which recognizes the past as a serious source of study, utilizing present problems in a peripheral rather than in a direct treatment. This approach is essentially classical in tone. It uses the vicarious experience of literature as an almost exclusive basis for learning. The social studies program at Sarah Lawrence College was selected to represent the liberal position; the Great Books program at St. John's College in Annapolis was selected to represent the conservative position.

Within this framework, the organization of the study includes a discussion of:

- (1) The nature of the social disciplines, in terms of basic objectives, the structure of a democratic society, and at the collegiate level of instruction,



- (2) An extended definition of the two philosophic positions, in terms of assumptions of the philosophy and specific tenets flowing from the assumptions,
- (3) An analysis of the two positions in terms of two specific college programs - Sarah Lawrence College and St. John's College, and
- (4) An appraisal of the two positions.

\* \* \* \* \*

The task of appraisal was a difficult one. It was accomplished (1) by establishing criteria by which the philosophic positions could be judged, and (2) by application of the criteria to the college programs. Both philosophic positions have essentially a common objective, namely, intelligent participation in the common life. The positions are at wide variance when it comes to the means of arrival toward this basic goal. In the final analysis, the liberal philosophic position, as exemplified by the Sarah Lawrence College program, was comparatively favored. It was found, by comparison, to be better keyed to the realization of the objective of the social disciplines in a democratic society than is the conservative approach at St. John's College.

\* \* \* \* \*

This philosophic study used as its fundamental method of procedure, a wide and intensive reading of the views held by some of the exponents of both positions. For the classical view some of the exponents included were Robert Maynard Hutchins, Stringfellow Barr, Scott Buchanan, Mortimer Adler, Walter Lippmann and John Spangler Kieffer. For the liberal approach some of the exponents included were John Dewey, Boyd Bode, Howard Mumford Jones, Constance Warren and Harold Taylor. Secondly, there was reflection, application and evaluation of the material read. This process was based partly upon the author's experience as a college teacher of the social studies, and upon

her understanding of the social disciplines. Visits were made to St. John's College and to Sarah Lawrence College. Both colleges were genuine in their interest, generous with their assistance and gracious with their freedom. The purposes of the visits were to acquire additional information and to secure something of the spirit and living tone of the two college programs. The visits were not designed for purposes of evaluation. Appraisal in this study emanated from reading, reflection and understanding.

\* \* \* \* \*

While this study in its final appraisal is sympathetic toward the liberal philosophy of the social studies in higher education, it is a sympathy that is relative in tone, and it is a sympathy which recognizes some of the virtues of the conservative view, as well as some of the limitations of the liberal approach. Moreover, the existence of the two positions is realistic to a democratic society, and quite understandable in a modern world that is both rich and confusing.

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Publication No. 982

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Library of Congress Card Number Mic A48-120



A NON-DENOMINATIONAL PROGRAM OF CHRISTIAN  
EDUCATION FOR A GROUP OF NEGRO CHURCHES  
SERVING THE NEGRO COMMUNITY OF  
ENGLEWOOD, NEW JERSEY

Colbert H. Pearson, Thesis (Ed.D.)  
New York University, 1948

The problem of this study was to discover those community factors which influence the well-being of a particular group, Negroes, in a selected locality, Englewood, New Jersey, and to show, in the light of these factors, how by strengthening and improving the programs of the churches of this group through Christian education these churches could render a greater service.

The Significance of the Problem

This problem seemed vital for the following reasons:

1. The constituency of these Negro Churches is traditionally loyal, and these churches enjoyed a relationship to their constituents which placed them in a favored position to render maximum service.
2. The churches and the social agencies felt the need of a more adequate knowledge of the local community in intelligently planning their programs. The facts discovered should be of importance also in future city-wide planning.
3. A thorough understanding of the problems of this community and how the churches may help to meet them, should resolve the lag between the rapidly changing community and the relatively static condition of the churches.
4. These churches are located in a typical urban community, with the Negro group concentrated almost wholly within a single geographical area. All

the problems, therefore, which confront members of this group living in any segregated area are to be found here, so this study should set the pattern for other communities searching for a more serviceable church.

Historically, the function of the church is an old problem, and much study has been done upon it, but comparatively little upon the Negro church. However, theoretically, it is assumed that these churches have a particular function in society. We accept without argument that they have a distinct contribution to make, a practical aim to achieve, a dynamic to impart and a method of approach toward community problems. This study sought to discover in terms of the Negro population of Englewood, New Jersey, what these functions and contributions should be.

#### Method and Treatment of Data

The method employed was the Social Survey technique which included surveys and interviews based upon questionnaires and schedules, and observation.

The following five surveys were made:

1. A survey of agencies and institutions to determine the extent and character of their facilities and program.
2. A survey of housing to determine the quality of, and the need for, more housing.
3. A survey of employment status as an index to well-being.
4. A religious survey to determine the church relationships of the group as a basis for church program expansion.
5. A survey of Negro school pupils from the fourth through twelfth grades to determine family status, interests and activities, group relationships, and vocational anticipations.

There were twenty-six scheduled interviews and many incidental ones.



All of the material was gathered at first hand, and this fact probably eliminated certain recognized weaknesses of the questionnaire method.

After the data had been tabulated and analyzed, they were then measured against accepted standards found in the particular fields under consideration. For example, those of the Southern Baptist Convention for a Standard Sunday School. Where no standard was found, the agency was measured against the unmet needs in its area of service.

### Findings And Conclusions

The method was very revealing. Many supposed factors which had been taken for granted were discovered not to exist, and many that existed were found to be purposeless and useless. Of the twenty-three agencies and institutions investigated, only one was found whose floor space and financial support were adequate for its present program. In building, equipment, program, finance, and personnel, all the others fell below standard requirements.

Resulting from this study, the following conclusions have been deducted:

1. That there is urgent need for all the social and religious agencies to strive for a better working relationship among themselves.
2. That as a measure of justice and community well-being, Negroes be admitted, advanced, and promoted on jobs according to their individual abilities.
3. That the total resources of the educational system, including personnel, be extended beyond the classroom into the community, wherever possible.
4. That health-training facilities be extended to Negroes.
5. In post-war planning for extensions and improvements of facilities, first consideration be given to housing, drainage, and transportation facilities, the neglect of which imposes hazards to public health.
6. That character building agencies seek to extend their services upon the basis of need rather than upon the basis of class or creed.

7. That the churches re-evaluate their programs and seek for a more meaningful approach to community problems.

8. That as a guide to the churches, the suggested program of the study be followed, as it shows ways and means for improvement in the areas of objectives, building and equipment, programing, finance, and personnel.

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Publication No. 983

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# STUDIES OF THE EYE-MOVEMENTS IN READING OF UNIVERSITY PROFESSORS AND GRADUATE STUDENTS

W. Robert Dixon, Jr., Thesis (Ph.D.)

Michigan State College, 1948

## 1. Review of the Conditions of the Study

This investigation has involved a study of the eye-movements in reading of three groups of University of Michigan professors, 16 subjects in each group, representing the fields of education, physics, and history. The reading materials were selected from the same three fields, and each subject read the material from his own field as well as the materials from the other two fields. A similar group of graduate students from each of the three fields was run through the same experiment.

Three pairs of reading selections were used in the study. These passages were equated for difficulty by the Flesch and Lorge formulas. One passage of each pair was used as a practice selection and the other as the test selection. All the passages were 200 words in length, printed on two cards of 100 words each. The type-size and line-length were constant and conformed to optimum conditions.

The Ophthalm-O-Graph was used to record each subject's eye-movements during the reading of the second 100 words of the test passage. Each test selection was preceded by a reading of the practice passage before the eye-movement camera. After each practice and test passage was read, a comprehension check test was given, consisting of five Yes-No questions.

## 2. Summary of the Results

Four measures were used to analyze the eye-movement records of the 48 professors and 48 graduate



students who were included in the experiment: (1) rate of reading in ems per minute, (2) number of fixations per em, (3) number of regressions per em, (4) number of refixations per line. In addition, a comprehension score was computed in terms of per cent. The problems studied dealt with the effect of familiarity of material on reading performance, types of reading as a factor in reading performance, the effect of training in a special field on reading performance, individual differences among the subjects, omnivorous readers, and rhythm reading. The results may be summarized as follows:

(1) All of the professor groups, plus the physics graduate students, read the passage from their own field most efficiently. However, statistically reliable differences were found only in the case of the physics subjects who read the physics passage significantly faster than they read the education and history passages, and who made significantly fewer fixations per em in reading the physics passage than they did in reading the other two passages.

(2) Neither the science material nor the history material elicited a special type of reading.

(3) The training the physics subjects have had in technical areas evidently has not served to slow down their reading in other fields.

(4) Some evidence was found which seems to indicate that the training of the history subjects may have operated to speed up reading.

(5) The intra-passage individual variations were vastly greater than the inter-passage group variations and tended to over-shadow any questions of types of reading and special training.

(6) No readers were found who made single fixations per line or paragraph. The average reading performance was about 300 words per minute and eight or nine fixations per line. The fastest individual performance on any paragraph was 596 words per minute.

(7) Some evidence was found that fast readers tend to repeat the pattern of their eye-movements from line to line. Some evidence was also found that



fast readers are skillful in the art of skimming, which results in arhythmical eye-movements.

(8) The reading of the graduate students was found to be comparable to that of the professors.

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Publication No. 1042

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AN ANALYSIS OF SELECTED SOCIO-ECONOMIC STATUS  
DATA FOR THE PURPOSE OF DETERMINING THE CONTENT OF AND  
THE CONDITIONS UNDER WHICH A PROGRAM OF EDUCATION  
MAY BE CARRIED ON BY AND FOR THE NEGRO ADULTS  
OF CHESTERFIELD COUNTY, VIRGINIA

Albert Terry Harris, Thesis (Ph.D.)  
University of Michigan, 1948

The purpose of this investigation is to make an analysis of selected socio-economic data for determining the content of and the conditions under which a program of education may be carried on by and for the Negro adults of Chesterfield County, Virginia. The data were secured by interviews with the heads of 250 Negro families, a 25 per cent random sample of the population under consideration and were arranged to reveal first, relationships between socio-economic status of Chesterfield Negro adults and that of other groups as well as minimum standards for the nation; and second, relationships between various combinations of socio-economic factors on the one hand, and between these combinations and the age of the subjects on the other hand.

This inquiry is based on the viewpoint that education may be a major instrument in the hands of adults for bettering their style of living and that a program designed to achieve this goal requires a knowledge of the particular patterns which socio-economic factors assume in the community for which the program is intended.

It was not regarded as the province of the investigation to determine the cause of the relationships between the various factors that were selected for examination. Neither was it considered the task of this study to plan a program of adult education



for the three communities involved. But an attempt was made to examine the data for recommendations both as to the content of a program and the conditions which might limit or facilitate its operation.

More than seventy-five major findings support the need for removing illiteracy, raising the general level of formal education, instruction in occupational adjustment and in the repair of houses, health and consumers' education, recreational and leadership training, and education for developing the recognition of the importance of making available to all citizens the human and material resources of the community.

The results also suggest that the following conditions should be respected in setting up a program of education for the Negro adults of Chesterfield County: (1) The high percentage of home ownership and stability of residence justifies long-term planning for adult education. (2) The high rate of illiteracy and low educational level indicate a need for face to face contacts as a means of communication. (3) Because of large membership and attendance, existing secular and religious organizations provide excellent access to the adults of the community. (4) The general desire for further education indicates the presence of a favorable climate for adult education. (5) Because of a higher level of education, leadership will more likely be found among members of non-religious than religious organizations. (6) Less frequent participation in community activities on the part of heads of families with children under six years of age indicates that provision should be made to care for little children in order to secure the involvement of their parents in programs of adult education. (7) Because young adults take part in organizations less frequently and have a higher level of educational achievement than their elders, special measures should be taken to secure their involvement and the service of their leadership in programs of adult education.

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Publication No. 1054

Microfilm copy of complete manuscript 240 pages  
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## THE ORGANIZATION OF POST-HIGH SCHOOL EDUCATION IN FLINT

Arthur Edward Lean, Thesis (Ph.D.)  
University of Michigan, 1948

This study attacks the problem of possible expansion of post-high school education in Flint. Socio-educational aspects of the problem are considered; financial aspects are omitted since they are the subject of a separate study.

Two possible lines of expansion are investigated: vertical, involving addition of two more years of work above the level now provided by Flint Junior College; and horizontal, involving broadening of the curricular offerings at the junior college level.

Methods of investigation included questionnaire surveys of Flint Junior College and Genesee County high school senior students to determine their appraisals of existing opportunities, plans for further education, curricular desires, and attitudes toward creation of, and attendance at, a standard four-year college in Flint. Another survey secured information on the number of Genesee County resident students attending the various Michigan institutions of higher learning.

The post-high school situation in Flint is examined in the light of the national situation at this educational level. Developments such as the rise of the junior college, bisection of existing colleges into upper and lower divisions, appearance of General Colleges and Freshman Colleges, branch universities, municipal institutions of higher learning, and the six-four-four organizational pattern have come mainly in the past fifty years. Such significant documents as Education for All American Youth and the recent



report of the President's Commission on Higher Education recognize the growing tendency among educators to regard the thirteenth and fourteenth grades as primarily general education which is secondary rather than collegiate in character and should therefore be provided locally and tuition-free for all interested youth as part of the public school system. A new institution, the community college, is envisioned as the agency to provide this extension of high school work.

Analysis of the data secured leads to the following conclusions regarding post-high school education in Flint:

(1) The present college population from Genesee County is upwards of 3,000 students, nearly one-third of whom are at Flint Junior College another third divided between the University of Michigan and Michigan State College, and the rest in miscellaneous other institutions.

(2) Flint Junior College, now housed in an inadequate and unsuitable plant, is overcrowded. The student mortality rate has been high.

(3) Strong student interest is indicated, especially by high school seniors, in various terminal occupational courses not now available in Flint. Local provision of this training would broaden the enrollment base and tend to democratize education at this level.

(4) Strong desire is also revealed for Liberal Arts, Pre-professional, Engineering, and Business Administration courses above the junior college level.

(5) The potential enrollment of a standard four-year college in Flint would probably be more than 2,000 students.

(6) The traditional four-year college shows signs of obsolescence. Creation of more such institutions is therefore of doubtful wisdom.

(7) Reorganization of post-high school education in Flint should recognize state advocacy of local provision of the thirteenth and fourteenth grades.

(8) Whatever organizational plan is followed, post-high school education in Flint should be responsive to community needs through development of a community-centered program.

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Publication No. 1060

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## DIFFERING FACTORIAL ABILITIES OF UNGRADED BOYS WHO LATER BECAME CRIMINALS

Henry Obel, Thesis (Ph.D.)  
University of Michigan, 1948

To explore the possibility of predicting criminality among maladjusted boys by an analysis of certain educational, sociological, and psychological records, a follow-up study was made of behavior-problem boys formerly enrolled in the Moore School for Boys (an ungraded school), Detroit, Michigan. On the basis of records made during school attendance 103 former pupils found to have been convicted of crimes other than misdemeanors five years after leaving school were compared with 105 who had no criminal record during the same period of time. The average age at the time of the follow-up contact was 19.5 years for the non-criminal group and 19.8 years for the criminal group.

The entire population had a mental level in the dull-normal range, low socio-economic status, and a correspondingly low educational achievement level in reading comprehension, vocabulary, arithmetic computation, and arithmetic reasoning. It was found that the criminal group tended to be more incorrigible as ungraded pupils and participated in more juvenile crimes against property. There was evidence also that the criminal group came from a less stable home environment.

Comparison of eleven test and sub-test scores of the Detroit Alpha Intelligence, Detroit Mechanical Aptitudes, and McCreary Rhythm and Pitch tests did not differentiate the groups. Of the 55 intercorrelations obtained from these test scores the criminal group correlations were found to be higher than those of the non-criminal group.



A factor analysis was made of these intercorrelations to determine the existence of differences in mental organization which would account for later criminal behavior. Application of the Thurstone centroid method yielded four factors, which were rotated by a method of successive approximation into a simple structure. Two factors emerged: mechanical-spatial and verbal.

For both the criminal and the non-criminal groups the verbal factor pattern remained invariant. General information, verbal opposites, reading, and verbal reasoning sub-tests of the Detroit Alpha Intelligence Test were included in this factor.

The mechanical-spatial factor pattern differentiated the groups. In the non-criminal group that factor included a maze tracing test of the Mechanical Aptitudes Examination, but did not include the number series test of the Detroit Alpha Intelligence Test. In the criminal group the number series was represented to the exclusion of the maze tracing test. The tests common to the mechanical-spatial factor were the Mechanical Aptitudes tests of tool information, visualization, and sorting.

It is concluded that maladjusted boys who exhibit a mental organization of greater complexity as evidenced by a more generalized mechanical-spatial factor tend to continue in an anti-social behavior pattern until culminated in some form of criminality.

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Publication No. 1068

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A STUDY OF THE RELATION OF MUSIC INSTRUCTION  
DURING SECONDARY SCHOOL YEARS TO ADULT MUSICAL STATUS,  
AS REFLECTED IN THE ACTIVITIES, INTERESTS AND  
ATTITUDES OF RECENT HIGH SCHOOL GRADUATES

Gertrude Emilie Stein, Thesis (Ph.D.)  
University of Michigan, 1948

The purpose of this investigation is to study the relation of music instruction during secondary school years to adult musical status as reflected in the activities, interests and attitudes of 200 recent high school graduates of the Springfield, Ohio, High School.

The subjects were selected alphabetically by chance from the high school records of the graduating classes of 1935 to 1945 inclusive. One hundred had taken (i.e. were participants in) elective music courses in high school. Another hundred had not elected (i.e. were non-participants in) such courses. They were matched as to (1) high school graduation, (2) sex, (3) age, (4) and academic average.

Data of the study were derived from high school records, inventories, and a journal of remarks, and were arranged to reveal the relationship of varying amounts of pre-graduation school and out-of-school music experience to post-graduation musical status.

The principal results are: (1) vocal work was by far the participants' most popular high school music activity. (2) An impressive interest in music was manifested in the childhood homes of both participants and non-participants. Moreover, both groups had taken active part in out-of-school musical activities before graduation. (3) A definite relationship seems to exist between pre-graduation musical experience and adult musical status. In general, participants who had both superior school and non-school musical background show a higher adult musical status.



(4) However, when both groups had equal and sizeable amounts of pre-graduation non-school musical experience, it was found that the election of high school music by the participants bore little relation to a better adult musical status, except for performance in a church choir. (5) On the other hand, when high school instruction was a constant, added amounts of pre-graduation non-school musical experience were definitely related to a superior adult musical status. (6) The participants were more confident than their partners of their sight-reading ability and their knowledge of classical musical compositions. (7) It appears that there is a closer relation between the kinds of pre-graduation non-school and adult musical activities and interests, than there is between school instruction and adult musical activities. (8) Both groups of graduates, in adulthood as in youth, show more interest in light-classical, swing and popular music than they do in classical music. Furthermore, few subjects attend concerts. (9) In general, graduates have an amateur, not a vocational interest in music. (10) For both groups of subjects there is a great loss in individual and group performance between the pre- and post-graduation years. (11) In spite of the drop in adult performance, music plays an important role in the leisure time of the graduates. (12) Although the majority of both groups state, in retrospect, that they liked their secondary school musical experiences, they assign more important ranks to the home, church, radio and the private teacher than to the school as determinants of their present interest in music. In general, the data give ample support for many recommendations concerning secondary school music instruction and its relation to the non-school musical community.

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Publication No. 1080

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## ETHNOZOOLOGY

### AN OSTEOMETRIC ANALYSIS OF SOME ABORIGINAL DOGS

William George Haag, Jr., Thesis (Ph.D)  
University of Michigan, 1948

A common practice of the earlier aboriginal occupants of North America was the careful disposition of dogs in burials, oftentimes with human beings. This practice was more common in the earliest archeological horizons in North America and largely was abandoned in later times. By a statistical treatment of the measurements taken on dog remains recovered from the archeological sites, it has been possible to differentiate various groups of dogs, but these groups represent modal points in a biological continuum rather than distinct types of dogs. Where a sufficiently large sample was available, it could be shown that the smaller dogs are always associated with older archeological strata; the larger dogs are to be found in the later archeological horizons. In addition, a correlation was found between the size of the dogs and the degree of cultural attainment of the owners of the dogs--the lower cultural horizons include small dogs and the more advanced, larger dogs. It is concluded that the larger size is the result of artificial selection on the part of these primitive peoples over a period of several thousands of years. There is little evidence to support the contention that crossbreeding with wild canids has effected a size increase in domestic dogs.

The specimens included in this study were obtained from shell heaps in Alabama and Kentucky, from a variety of sites in the Southwestern area, from shell heaps of the Northwest Pacific Coast area, from

a site on Kodiak Island, from eastern North American sites classified in the Woodland and Mississippi archeological categories, from St. Lawrence Island and eastern Siberia, and from the modern Eskimo of Greenland and Alaska.

The findings of this study indicate that the ancestral form from which the varieties of domestic dogs arose was a small wolflike canid of Pleistocene age that probably appeared as a mutation. Because of its small size and the resulting increase in competition with other forms, this ancestral dog attached itself to man. There is no direct evidence of the presence of the domestic dog in Europe and Africa before 6000 B.C., and there is no direct evidence of the domestic dog in North America prior to about 1500 B.C.

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Publication No. 1051

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## GAME AND GAME-BIRDS

### A GAME INVENTORY OF ALABAMA

Frederick S. Barkalow, Jr., Thesis (Ph.D.)  
University of Michigan, 1948

To determine the status of Alabama's game resources and to find those species needing immediate attention, the Department of Conservation of the State of Alabama sponsored a Pittman-Robertson project entitled "Inventory of Wildlife Resources of Alabama (1-R)" from October 1, 1939 to June 1942. This paper contains the results of attempts by the project personnel to secure population data on the major game species and to determine population trends in the other forms.

Reliable state-wide quail population figures were obtained by working three to five bird dogs together. Dogs trained especially for this work proved most satisfactory. Quail census results when a single dog was used, were not dependable. Indices such as "Coveys (or birds) per dog per hour (or day)" are apparently worthless in the Southeast. Warden dog censuses for quail furnished valuable and reliable data when the sample areas were selected by the research personnel. Quail censuses by sportsmen's groups were generally unreliable. A drive census gave reliable data but labor costs make the method prohibitive for state-wide use. Stoddard's unmated cock whistling index proved of considerable value in determining the summer quail population on large areas.

State-wide personally administered questionnaire surveys furnished reasonably accurate quail population data and information for plotting the distribution of turkey, deer, and beaver.

Turkey population estimates were made by extending data obtained on small areas to the entire occupied range in each area. The Mosby-Handley technique was also employed. The average brood size gives an index for evaluating nesting success.

Deer populations were estimated by extending data obtained on areas of known populations to all occupied ranges.

A reliable waterfowl census was made in Alabama by photographing the rafts from the air. Waterfowl population estimates by experienced wardens were reasonably accurate. Evaluations by sportsmen were generally unreliable.

Beaver populations were estimated by field evaluations of active dens, cuttings and "sign". No arithmetical index could be assigned to any single factor.

The drive census was the only technique tested that gave reliable figures on rabbit populations. Pellet counts, dog counts, and average flushing distance counts furnished indices of doubtful value.

Leaf nest counts was the only practical census method found which could be used to obtain a density index for squirrels on a state-wide basis.

Warden opinion of the game trends in his district furnished a valid index to state-wide trends when the district reports were plotted on state maps. Warden trends appeared more reliable than those obtained from farmers.

Actual state-wide population estimates were made on quail, turkey, deer, waterfowl, and beaver. Only population trends were obtained for other species.

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Publication No. 1040

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## GEOLOGY

### GENESIS OF THE MIGMATITES AND ASSOCIATED PRE-CAMBRIAN FORMATIONS NEAR BERGEN PARK, COLORADO FRONT RANGE

Norman Ray Snively, Jr., Thesis (Ph.D.)  
University of Michigan, 1948

The area mapped lies north and west of the topographic depression known as Bergen Park, in the Colorado Front Range, thirty miles west of Denver and six miles east of Idaho Springs. The principal rock types are metamorphosed pre-Cambrian formations disposed in overturned, isoclinal folds.

The oldest rocks are those in the Idaho Springs formation, consisting of biotite schist, biotite-sillimanite schist, lime-silicate gneiss, and quartzite. The formation is believed to represent a sedimentary series, originally composed of interbedded shales, limestones, and sandstones, which has been altered to its present state by regional metamorphism.

No member name is proposed for the hornblende gneiss found within the Idaho Springs formation because it is of more than one origin. It is believed that some of the hornblende gneiss layers are regionally metamorphosed marl-like sediments interbedded with the Idaho Springs beds and, therefore, are properly members of that formation. Others may be of igneous origin, representing metamorphosed mafic, igneous rocks, volcanic tuffs or flows, sills, and possibly dikes. Consequently, the hornblende gneiss in part may be equivalent in age to the Idaho Springs formation and in part may be younger. The majority of the hornblende gneiss layers are not readily separable on this basis, so it is easier to group them together on a lithologic rather than on a genetic basis.

The gneissic aplite is an igneous rock intrusive into the members of the Idaho Springs formation and the hornblende gneiss and was metamorphosed in company with them.

The Boulder Creek quartz monzonite was intruded into the Idaho Springs formation and the hornblende gneiss during a period following the regional deformation which produced the schists and gneisses from the sediments of the Idaho Springs formation.

The origin of the biotite gneiss is complex. The rock is similar to the quartz monzonite gneiss of earlier workers and has been mapped as such in this area by a previous survey. In the present report, a new name is used, first, because the term quartz monzonite gneiss implies too strongly an igneous origin for a rock believed to be only partially igneous; and, second, because the work in this small area does not justify attaching a similar complex origin to all bodies of quartz monzonite gneiss in the Front Range. The biotite gneiss is believed to be a migmatite, the result of replacement of the Idaho Springs schist, quartzite, and lime-silicate gneiss by hydrothermal solutions originating in the Boulder Creek intrusive.

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Publication No. 1077

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## HISTORY

### THE EARLY ANTISLAVERY MOVEMENT IN OHIO

Richard Frederick O'Dell, Thesis (Ph.D.)  
University of Michigan, 1948

The slavery exclusion clause of the Ordinance of 1787 did not achieve the outright abolition of slavery in the Northwest Territory. Nevertheless, the provision discouraged slaveholders from migrating into the Northwest and attracted to it instead a predominantly antislavery population determined to prevent the further introduction of slaves. In November, 1802, the Ohio Constitutional Convention drafted a constitution for the first state formed from the Northwest Territory. With little or no discussion the Convention retained the slavery prohibition of the Ordinance, but staunch Republican members by a narrow margin defeated attempts by the Federalist and more moderate Republican elements to extend the franchise to the free colored people of the new state. The final result was that Negroes were denied the right to vote or to hold office and thus were placed in the position of second-class inhabitants. The Ohio General Assembly, moreover, soon widened the breach between Negro and white by passing the discriminatory "Black Laws" of 1804 and 1807.

The active antislavery groups in Ohio, comprised chiefly of Quakers, Presbyterians, Congregationalists, and members of the Associate Reformed Church, with some Methodists and Baptists strove from the earliest period of settlement to maintain the Ohio slavery prohibition, to educate the free colored people of the state, and to secure the repeal of discriminatory legislation. At the same time friends of the Negro began to agitate for the gradual abolition of slavery in the South and to facilitate the escape of increasing



numbers of fugitive slaves who sought refuge in Ohio. The Quakers Benjamin Lundy, Charles Osborn, and Elisha Bates soon after the War of 1812 conducted an organizational and newspaper campaign in Belmont and Jefferson counties. In the 1820's James Gilliland, John Rankin, Dyer Burgess, Samuel Crothers, and other ministers of the Chillicothe Presbytery spearheaded attempts to purge the Presbyterian Church of slavery. Similar agitation was carried on in the Associate Reformed Church by such men as David McDill, John Walker, and Alexander Porter. In the anti-slavery work Ohioans of Southern extraction stood firmly with those of New England and Middle State backgrounds.

The Missouri contest convinced many white residents of Ohio that Southern slaveholders were determined to perpetuate slavery and to defend it as a positive good. As slavery spread, the number of free colored people would increase, and the prospect of Ohio's being used by Southerners as a dumping ground for poverty-stricken and illiterate Negroes was not pleasing. Therefore, some Ohioans began to demand more rigid enforcement of the "Black Laws" and to support the movement to colonize in Africa the free colored people of the United States. A few rabid citizens of Cincinnati and other communities forcibly expelled to Canada a large number of colored inhabitants. Some of the whites who were more alarmed by the evils of slavery than by the presence of a large free Negro population either did not support colonization or broke away from it and turned from gradual abolition to the espousal of immediate emancipation. The fact that the transition from gradualism to immediatism was accomplished slowly illustrates the evolutionary character of the anti-slavery movement in Ohio.

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Publication No. 1069

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## HORTICULTURE

### RESPONSES OF ROSE VIRUSES AND THEIR HOST PLANTS TO HEAT TREATMENTS

Samuel Owen Thomas, Thesis (Ph.D.)  
Purdue University, 1946

This investigation has been made in an effort to study the possibility of controlling rose virus diseases which are widely disseminated and of economic importance to the commercial growers.

Rose plants infected with virus exhibit dwarfing, lack of vigor, poor root development, abnormal foliage, and distorted flowers as well as reduced blooming in many instances. There are a number of different symptoms of the diseases which vary in nature and intensities from one virus to another, and in different varieties of roses. However, each virus has typical symptoms which characterizes that virus.

Virus diseases of roses have been transferred by various methods of budding and grafting used by commercial propagators; and transfer of virus occurs when tissue union takes place. There were no indications of virus transfer by seed. Therefore seedlings were used for indexing rose material to ascertain whether rose viruses were present, to eliminate the possibility of viruses being present in masked form.

The method of indexing used in this investigation made it possible to use relatively small seedlings by placing the buds just above the crown of the seedlings.

It appears that the critical temperature for rose tissue is  $52^{\circ}\text{C}.$ , and this temperature can be endured for a period not to exceed two minutes.

It is apparent that rose viruses were not inactivated by thermal treatments which were at temperatures as high as  $52^{\circ}\text{C}.$  for periods of time

approaching the limit of thermal tolerance of rose tissues. Also, the viruses were neither attenuated nor modified by heat treatments.

### Vita

Birth: Lagrange County, Indiana, September 5, 1901.

Education: Public Schools of Lagrange and Elkhart Counties.

Millersburg High School, Millersburg, Indiana, 1920.

Wittenberg College, Springfield, Ohio, B. A., 1933.

Goshen College, Goshen, Indiana, B. S. in Ed., 1934.

Purdue University, Lafayette, Indiana, M. S. in Botany, 1940. Thesis: The Effect of Known Fungus and Bacterial Cultures upon the Subsequent Growth of Fungi, in the Same Medium.

Further work toward Doctor of Philosophy Degree in Botany and Horticulture Departments.

#### Research Work:

Staff member, Assistant in Horticulture, Purdue University, 1941-1943, conducted research on rose viruses for Society of American Florists.

Research worker for Lederle Laboratories, Inc., Pearl River, New York, 1943 to present, working on penicillin, streptomycin, and other antibiotics.

#### Professional Organizations:

Sigma Xi.

American Phytopathological Society.

Society of American Bacteriologists.

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#### Publication No. 988

Microfilm copy of complete manuscript 94 pages at 1 1/4 cents, total cost \$1.18, paper enlargements 6" x 8", at 10¢ per page. Available from University Microfilms, Ann Arbor, Mich.

Library of Congress Card Number Mic A48-136



LANGUAGE, GREEK

THE TEXT TRADITION OF  
CHRYSOSTOM'S COMMENTARY ON JOHN

Paul William Harkins, Thesis (Ph.D.)  
University of Michigan, 1948

This dissertation is a preparation for a new text of the 88 homilies of Chrysostom's Commentary on John, and it proceeds by studying mss. and existing editions. The mss. were chosen because of availability or because they had been basic to the editions; they were studied by collating them with Savile's textus receptus in four homilies. The collation showed that the mss. belonged to two well-defined family groups, A and B. The character of the variants between the family groups led us to formulate a theory of two recensions, which we consider certain for the homilies collated and probable for the rest. The recensions follow the family groups, and because Family A shows a "rougher" text, we think that it is prior to Family B which apparently is a deliberate and extensive rewriting of the homilies as shown in the mss. of Family A.

By repeating the collation and substituting Commelin's 1603 Heidelberg edition as the lemma, we were able to discover the editorial principles of both Commelin and Savile. Commelin used three mss. for his edition, but Codex Palatinus Graecus 373 was the basis for his text and the other two were used as occasional controls. Pal graec 373 is a Family B ms. and, consequently, Commelin's text is an almost pure representation of that recension. Savile used Commelin as a control for his Magdalen College ms. in Homilies 1-46 and controlled the Heidelberg text by a collation of some Paris ms. in Homilies 47-88.



Both the Magdalen and the Paris mss. belong to Family A, but but because of the eclectic principle of the editor and his unequal emphasis on the Heidelberg text, Savile's edition of 1613 is of uneven value and does not present a consistent text. The later editions are so influenced by these earlier texts that they can scarcely be considered an improvement.

The ms. translation of Burgundio was interesting and useful because of its extremely literal character and because in it Homilies 1-44 are based on a B ms., and Homilies 45-88 on a ms. of Family A. It also points to a phenomenon of division into two parts which we notice in the majority of mss. and which we solved tentatively on the assumption that a complete ms. would have been in most cases well over 400 folia and too bulky for practical use.

The proposed new critical edition should be based on the following theories which, within limits, are sure:

1. There are two families of mss., A and B.
2. These two families represent two recensions.
3. Family A is "rougher" than Family B.
4. Family B is probably a recension of Family A.
5. Family A, then, is probably prior to Family B.

The new edition will present the text of Family A, basing it on the best available mss.; the critical apparatus will give all the readings peculiar to the recension preserved in Family B, and the most important variations within Family A. This text would be consistent and, we think, scientifically closer to the exact sermons preached by Chrysostom than is any existing printed edition.

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Publication No. 1053

Microfilm copy of complete manuscript 263 pages  
at 1 1/4 cents, total cost \$3.29, paper  
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Library of Congress Card Number Mic A48-152



## LITERATURE, AMERICAN

### THE IDEA OF TRAGEDY IN MODERN AMERICAN DRAMA

Arthur Gould, Thesis (Ph.D.)  
University of Michigan, 1948

It is the purpose of this work to examine the corpus of modern American critical theory, as well as the major philosophic concepts that relate to the tragic vision of existence, in order to see the relationship between basic modern values and what may be called "the idea of tragedy." The major concepts examined are those of the naturalists, the humanists, and the dialectic materialists. A distinction is made between "crude" or literary-scientific naturalism of the Zola tradition and "critical" or philosophic naturalism of the kind explicated by James Bissett Pratt and others who do not deny teleology in the universe. Among modern playwrights, Eugene O'Neill is seen as representing the most characteristic aspects of naturalism, and as achieving, moreover, the nearest approach to a resolution of the conflict between humanistic and naturalistic values.

In Maxwell Anderson is found the dilemma of the dramatist who, unable to deny the values of the naturalistic world of which he is a part, still adheres to the humanistic conventions of the past--conventions such as conflict between supernatural good and evil, the noble protagonist, and poetic language. It is argued that Anderson fails to resolve the dichotomy between naturalistic and humanistic values and that consequently his dramatic symbolism is confused and confusing.

Marxian drama, by the very nature of the theory of dialectic materialism which it employs, is essentially non-tragic.

After the variables and constants of tragedy have been traced and several conventions held by the traditionalist critics as essential to tragedy have been rejected, a definition of the art is proposed. According to this definition, the essentials of tragedy are 1) an action that makes man aware of his perilous place in the universe while at the same time helping to integrate him with what is best in his age; 2) a protagonist who is representative of the most characteristic aspects of his age; 3) finality; and 4) language contributory to the dual tragic function of increasing awareness and effecting integration. It is concluded that some of our modern dramatists have had the tragic view and have possessed the artistry necessary to the creation of dramatic tragedy that has validity for the present age.

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Publication No. 1050

Microfilm copy of complete manuscript 350 pages at 1 1/4 cents, total cost \$4.39, paper enlargements 6" x 8", at 10¢ per page. Available from University Microfilms, Ann Arbor, Mich.

Library of Congress Card Number Mic A48-149



## MARK TWAIN AS A CRITIC OF EUROPE

Arthur Lincoln Scott, Thesis (Ph.D.)  
University of Michigan, 1948

During the past fifty years literary criticism has examined many aspects of Mark Twain's writings. Conflicting interpretations of Twain's life and work have frequently bred internecine literary battles. To a large extent the dust, the din, and the cries of these battles have tended to obscure an important phase of Mark Twain's career: his associations with Europe.

Between his well-publicized Mediterranean voyage in 1867 and the death of his wife in Florence in 1904, Mark Twain spent more than one-third of his life abroad. During this period his critical comments upon the European scene were both shrewd and voluminous. Spanning, as they do, four decades, these observations manifest certain changes of temper, certain alterations of viewpoint. Some of these changes were permanent, others only temporary.

Although Twain's reaction to foreign life and institutions is most widely known through The Innocents Abroad (1869) and A Connecticut Yankee in King Arthur's Court (1889), neither this first travel book -- much maligned by critics -- nor this fantastic Arthurian tale is representative of more than a transient opinion. In his later life, especially during the 1890's when he resided almost entirely in Europe, Mark Twain began to experience from within that foreign life which he had previously reported mainly from external observation. Increasing knowledge caused him to revise many of his earlier, less mature judgments. A study of Twain's letters, notebooks, and other private utterances during his late years shows the great extent to which his rough, careless frontier nature developed under the cultivated



influences of genteel society, until he became largely reconciled to many of those undemocratic or oppressive aspects of European civilization which at one time or another he had censured without mercy.

In seeking to assign to Mark Twain a place in American letters as a critic of foreign culture the present study commences with a survey of nineteenth century American attitudes towards Europe. Particular emphasis has been placed upon the writings of Irving, Longfellow, Cooper, Hawthorne, and Henry James -- authors whose works represent the significant attitudes, ranging from almost worshipful idealization of Europe to bitter animosity.

With none of his predecessors was Mark Twain in conscious or lasting harmony. In his preoccupation with the modern scene, however, and in appraising Europe by the realistic, humanitarian standards of the present, Twain was in essential accord with the more contentious Fenimore Cooper, who had pitilessly denounced the sentimentalizations of Europe by alleged tufthunters such as Irving and his followers.

Though never completely insensible to the mysterious lure of the Old World, Mark Twain remained the American par excellence, temperamentally incapable of becoming an uprooted cosmopolite like Henry James. Speaking, therefore, always in the American idiom, and constantly representing the ideals of his homeland in broadly universal terms, he buttressed international amity by illustrating -- both in his life and his letters -- the indivisibility of the human race. Unlike the romantic voyagers who had drawn America back to the old reservoirs of European culture, Mark Twain continually drew Europe closer to the new springs of America.

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Publication No. 1073

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Library of Congress Card Number Mic A48-172



## LITERATURE, ENGLISH

### THE EFFECTS OF THE WESLEYAN MOVEMENT ON THE BRONTE SISTERS, AS EVIDENCED BY AN EXAMINATION OF CERTAIN OF THEIR NOVELS

Donald B. Thorburn, Thesis (Ph.D.)  
New York University, 1947

The problem of this investigation was to determine if the Wesleyan or Methodist Movement affected the writings of the Bronte Sisters to the point where the effect was evident in their novels.

The investigation was divided into three sections dealing with:

1. John Wesley and the impact of the Methodist Movement upon England up to the mid-nineteenth century.
2. The extent of the exposure of the Bronte Sisters to Methodism.
3. An examination of the novels of the Bronte Sisters to discover possible evidences of a reaction to Methodism in these writings.

In section one of this investigation, that relating to John Wesley and the Methodist Movement, the life of John Wesley was studied in some detail. Wesley's boyhood, the influence of his mother, the 'Holy Club' at Oxford, Wesley's ministry, the beginning of the 'Societies', and other important steps in Methodist organization were described.

In section one, the religious, social, and political effects of Methodism upon the English people were considered. The effect of the Methodist Revival as a deterrent to revolutionary changes in England, and Methodism as a stimulus to education through Sunday-schools, parish schools, and national schools were noted. The effect of the Methodist Movement on missions, and in the development of the missionary



spirit, Methodism as the cause of the Evangelical Movement within the Church of England; the Movement's reactivation of the various Non-conformist bodies; its importance in developing trade-unions; its attitude toward liquor; its intolerance of Catholics; and its part in the development of a new moral enthusiasm in England which resulted in nineteenth century Victorianism, were all considered in this section.

In section two of the investigation, dealing with the Bronte Sisters' exposure to Methodism, was described the Methodist family background of the Brontes--the strength of Methodism in Haworth, the impressions made on the youthful Brontes by Methodists, and by Methodist books and magazines, the influence of Charlotte Bronte's friends--the Dissenting Taylors, and of Miss Branwell--the Brontes' Methodist Aunt, descriptions of Charlotte's conflicts with High-Church curates, with Catholics and Catholicism, and descriptions of the general Methodist attitudes of the Brontes.

In section three a search was made of the Brontes' novels (The Professor, Jane Eyre, Shirley, Villette, by Charlotte Bronte; Wuthering Heights by Emily Bronte; Agnes Grey and The Tenant of Wildfell Hall by Anne Bronte) to discover those places in their books where the Sisters show that they were exposed to Methodism or its effects. It was noted from their novels that Methodism affected the Bronte Sisters both consciously and unconsciously. The conscious relationship with Wesleyanism was through contact with Methodist relatives, with the Methodists of the vicinity, with friends who were Methodists, and through Methodist literature.

The contacts with Wesleyanism or its influences which the Brontes experienced unconsciously are represented in their novels in situations of a social or religious nature, and came to them mainly through Evangelicals or Low Church, which represented the impact of Methodism upon the Established Church of England. Examples of the effects of Methodism which the



Brontes experienced unconsciously are the Brontes' attitude toward liquor, toward dress, their anti-Catholic feeling, their sabbatarianism, their anti-High Church feeling, their attitude toward the sanctity of daily work, their connection with Sunday-schools and parish schools, their use of the Bible for quotation and daily guidance, their humanitarianism, their belief in the worth of the common man, their belief in salvation through free choice, and their enthusiasm for the Evangelical type of religion and for missionary work.

It was found to be the Brontes' reaction to Methodism, a reaction both conscious and unconscious, that colored much of their writing. Methodist people, and the Methodist attitudes noted above were all mirrored in the novels that found their origin at Haworth parsonage. The Bronte Sisters never were members of a Methodist chapel, but they were the spiritual children of Methodism as expressed mainly through the Evangelical Movement in the Established Church. Of this fact their novels give ample proof.

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Publication No. 980

Microfilm copy of complete manuscript 257 pages  
at 1 1/4 cents, total cost \$3.22, paper  
enlargements 6" x 8", at 10¢ per page. Available  
from University Microfilms, Ann Arbor, Mich.  
Library of Congress Card Number Mic A48-118

COLERIDGE AND ELIOT: A COMPARATIVE STUDY  
OF THEIR THEORIES OF POETIC COMPOSITION

Leonard Adrian Waters, Thesis (Ph.D)  
University of Michigan, 1948

The work here undertaken is an analysis of Samuel Taylor Coleridge's and of Thomas Stearns Eliot's criticism of poetry, stressing each critic's concept of the nature of poetry and its application to problems of thought, emotion, and imagination in poetic composition. From this analysis, a comparison of the two theories emerges which indicates the source and extent of agreement and of incompatibility in the two.

Coleridge's comments on the nature of poetry reveal as the distinguishing mark of his criticism an insistence upon psychological and philosophical wholeness or unity in a poem. This general theory of wholeness directs Coleridge into a deeply humanistic criticism. It explains his admiration for poetic 'intuition' -- intuition which is not passive, but rather a complete and harmonious use of all man's intellectual and sense faculties. A passive, Plotinian intuition was attempted by Coleridge, but was rejected, and was never operative in his literary criticism.

A distinction between sentimentality and emotion is drawn and it is maintained that Coleridge, due to his theory of wholeness, demanded a rigid control upon emotion in great poetry. Sentimentality as the lack of harmony and balance was rejected by him.

Coleridge's distinction between fancy and imagination is also seen as an application of his overall insistence upon wholeness. True imagination is that which fuses the images into artistic wholes. Fancy is merely the power of associating images. Thus, imagination is in harmony with 'intuition' in Coleridge's search for organic unity.



Eliot's work, reflecting the influence of French Imagist, Symbolist, and Surrealist schools, first stressed a theory very close to aestheticism, and even showed a tendency to exploit in poetry the sub-conscious psychic powers of man. Since 1928, however, he has leaned toward cultural and religious traditions as poetic criteria. These two influences have tended to confuse his criticism with antithetical standards: harmony with the tradition of our Western culture or exploitation of the aboriginal forces of primitive society.

This divergence is held to have led Eliot to confusing literary judgments. Thus, intellectually, a kind of literary skepticism competes with a broadly humanistic standard of values in his comments upon thought in poetry. Again, a naturalistic interpretation of Eliot's objective correlative pits his criticism of emotion against that of Coleridge, but an exactly parallel humanistic treatment of emotion is likewise found in both critics. Eliot has tended to accent the individual image in his treatment of imagination, and has thus corrected a widespread plague of fuzzy imagery. In doing so, he does not, however, oppose Coleridge, but is in danger of losing Coleridge's salutary insistence upon the unity and controlling atmosphere behind the individual image.

It is therefore concluded that incompatibility between Eliot and Coleridge stems from radical theories either of false intuitionism or of aestheticism not essential to either critic, and that, eliminating these elements, both offer a solid foundation for a humanistic outlook which unites their work.

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Publication No. 1081

Microfilm copy of complete manuscript 390 pages  
at 1 1/4 cents, total cost \$4.88, paper  
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## MATHEMATICS

### PROBABILITY AND EXPECTED VALUES

Max A. Woodbury, Thesis (Ph.D.)

University of Michigan, 1948

The thesis is divided into three chapters, chapters are divided into sections and sections into paragraphs, all numbered.

In chapter I, the contribution of the work to the foundations of probability is discussed in general terms.

Chapter II opens with a summary of the basic concepts and notations used in the work. A basic entity, new in this work, is the quorum, a family of sets which contains with each pair of its sets, also their union if the sets are disjoint. Further the complementary set of each set in the quorum is also in the quorum. Trivially, the quorum is required to contain at least one set. The properties of probability measure functions over quorums and the P-extension of a quorum of sets are studied. Upper and lower integrals, integrability and integrals, inner and outer measure, measurability-P and measure are studied and the results shown to coincide with the usual theory when the quorum is a field.

Measurability of functions, distribution functions and the integrability of functions are next studied where the usual requirement of complete additivity is dropped. Following this the relation of the work to the usual theory is discussed in general terms in the light of this omission.

The last section of the second chapter is devoted to the study of certain linear functionals called expected values defined over a linear set called statistical sets of functions. Each expected value defines a probability measure function over a quorum of sets, and a strong statistical set leads to a field of sets. The relations between expected values and



integrals over the quorum are studied. An application of these results to the statistical set of bounded sequences is made. Here the expected value is the first Cesaro limit of the sequence.

Chapter III is a study of the invariance of functionals and measure with respect to Abelian semi-group  $G$  of transformations. The Hahn-Banach theorem of the extension of functionals is generalized to the case where the linear functional to be extended and the Hahn functional majoring the linear functional are both invariant under the semi-group. In that case it can be shown that extended functionals can be chosen so as to be invariant under  $G$ . The major result of the thesis follows: Let  $G$  be an Abelian semi-group of one to one transformations of a set  $\Omega$  into itself and  $p$  a probability measure function defined over a quorum of subsets of  $\Omega$  such that for all sets  $A$  in the quorum and all  $r$  in  $G$  one has  $p(rA) = p(A)$  (i.e.  $p$  is invariant under  $G$ ). Then there exists a probability measure function  $P$ , defined for all subsets of  $\Omega$ , such that  $\underline{p}(A) \leq P(A) \leq \bar{p}(A)$  and  $P(rA) = P(A)$  for all subsets  $A$  of  $\Omega$  and any  $r$  in  $G$ .

A bibliography is appended.

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Publication No. 1084

Microfilm copy of complete manuscript 76 pages  
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enlargements 6" x 8", at 10¢ per page. Available  
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Library of Congress Card Number Mic A48-183

## PALEONTOLOGY

### PRE-TRAVERSE DEVONIAN PELECYPODS OF MICHIGAN

A. La Rocque, Thesis (Ph.D.)  
University of Michigan 1948

The pelecypods of the pre-Traverse Devonian rocks of Michigan are described. Those of the Middle Devonian Traverse have been studied by Tsun-Yi Yang; their description is contained in an unpublished doctor's thesis at Yale University. Thirty-nine pre-Traverse species, fourteen of them new, have been recognized. They belong to twenty-three genera, three of which are new, and to fifteen families. The synonymy, description, occurrence, relationships, and type data are given for each species. Four tables showing the distribution of the species are presented. The stratigraphic and geographic distribution of the species are discussed together with their bearing on the correlation of the formations in which they occur. Localities are numbered consecutively and grouped together in a list. A list of references cited is given. The study is illustrated by nineteen plates showing figures of all the new species and some of those described previously.

The Garden Island formation composing the oldest Devonian rocks of Michigan has not yielded any pelecypods. The seven genera found in the overlying Bois Blanc formation include only two identifiable species, both of which are new. The pelecypods found in the next higher formation, the Sylvania sandstone, are too poorly preserved to have stratigraphic value. No pelecypods have been found in the Flat Rock dolomite in Michigan. A few species identified from the so-called Anderdon limestone of Sibley quarry and not



present in the Anderdon limestone of the type locality suggest that these formations are not of the same age. Only one species of pelecypod is recorded from the typical Anderdon. Five species of pelecypods are listed from the Amherstburg dolomite only one of which seems to be restricted to this formation. Five species are recorded from the Lucas dolomite, two of which appear to be restricted to it. The Dundee limestone of the southeastern and northeastern parts of the Southern Peninsula of Michigan have only two pelecypod species in common. The Dundee list contains fourteen species belonging to twelve genera. The Dundee pelecypod fauna is closely related to that of the Rogers City limestone and both in turn have close relationships with the Middle Devonian of Manitoba and the Eifelian of Europe. The Rogers City fauna contains fifteen species belonging to twelve genera. The species of the basal eight or nine feet of the formation, which consist of dolomitic limestone, are markedly different from those of the higher beds of the formation.

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Publication No. 1059

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## PHOTOGRAPHY

### PHOTOGRAPHY AND PHILOSOPHY: AN ESSAY ON THE ESTHETICS OF A NEW ART MEDIUM

Douglas N. Morgan, Thesis (Ph.D.)  
University of Michigan, 1948

Photography has achieved the status of a full-fledged medium among the fine arts. This fact raises certain interesting problems in esthetics.

A tentative philosophical background is developed, taking "pleasure-displeasure" as primitive, and defining "experience of a work of art" in primarily hedonistic terms. "Work of art," "artist" and "medium" are subsequently defined in terms of "experience of a work of art."

In selection and composition of material, choice of camera, lens, film, paper, etc., and in exposure and projection (cropping, dodging, etc.), the photographer has wide freedom for personal control of the finished picture. The camera is not a mechanical drawing instrument. Photographers have developed individually recognizeable styles, just as painters have.

Generalizing from older media, creative satisfactions are classified as "sensuous," "control" and "suggestive" (e.g., representative). Photography yields to the artist satisfactions of each of these kinds, in certain respects similar to and in other respects different from those of the older media. Likewise, corresponding satisfactions are enjoyed by the observer in appreciation. Sources of esthetic satisfactions in photographs are described.

A comparison with painting reveals parallels and divergences. The divergences appear to arise from the nature of photography as a medium, and not to justify its rejection on a priori esthetic grounds. Mutual influences between the two media, for good and for bad, are briefly traced in an historical sketch.



A comparison with sculpture reveals still other similarities and differences.

The central criticism of photography: that it is "too realistic" to be an art, is considered in some detail. Systematically, the general problem of representation in the graphic arts is considered in an analysis of a series of alternative meanings for the term "realism" in art: the naive meaning, the mathematical-perspective meaning, the psychological meanings, the practical meanings. Each of these meanings is examined for clarity, conformity to general usage, and applicability in critical contexts. All meanings conformable to usage are discovered to be "subjective" (not independently mensurable, and strictly dependent upon the user's psychological conditionings), and none seems to justify a priori rejection of photography as "too realistic." Some of the general implications of the realism-abstraction-subject matter problem are considered. Hospers' interpretations of "representation" are discussed and criticized.

Photography offers to the artist certain advantages: instantaneity, delicate ranges of tone gradations, and "verisimilitude," while placing him under certain limitations: some difficulty in composition, monocularity and (historically) the confinement to one color. Photographic treatment of the tragic and the comic are briefly considered.

Within photography, a battle over subject matter and treatment (purism vs. pictorialism) has raged. It has been partly verbal, and partly an insoluble dispute about taste. Photography can be an element in a mixed art.

Even under other theories of esthetics, the thesis seems (on briefer examination) to be acceptable: Prof. Pepper's "Formists," "Organicists" and "Contextualists," as well as his "Mechanists," can welcome photography.

Illustrations include works by Weston, Adams, Steichen, Käsebier, Abbott, and others. A bibliography on the esthetics of photography is appended.

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Publication No. 1065

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## PHYSICS

### THE CRYSTALLIZATION OF POLYMORPHOUS SUBSTANCES FROM THE VAPOR PHASE II

Stephen Edward Madigan, Thesis (Ph.D.)  
Purdue University, 1937

A method has been developed for the quantitative determination of the constitution of polymorphous mixtures using monochromatic X-Rays and intensity comparisons of coincident lines.

This method has been applied to the investigation of the crystallization of zinc sulfide from the vapor phase. It has been found that the amount deposited in the cubic or hexagonal form depends on pressure and temperature conditions. Two different processes have to be considered: formation of nuclei at the phase boundary (two dimensional nuclei) and formation of crystal nuclei in the vapor phase (three dimensional nuclei). The equilibrium between these two determines the final amount of the different phases present in the deposit. The results show that most of the crystal formation takes place in the vapor phase at high speed of evaporation indicating that Ostwald's Rule of Stages is approximately obeyed.

If the evaporation and deposition is conducted at a slow rate most of the nuclei seem to be formed at the interface as indicated by the prevalence of the hexagonal form on CdS and ZnO as compared to Cu and ZnS.

At higher temperatures transition from the unstable hexagonal phase to the stable cubic phase is indicated. The influence of the support is shown by the deposition on cadmium sulfide which apparently produces preference of the hexagonal form as compared with the deposition of the same form on cubic and other surfaces unrelated in symmetry to Wurtzite.

A special apparatus has been constructed to allow the cleavage of zinc sulfide single crystals in



a high vacuum and immediate deposition of zinc sulfide from the vapor phase on the cleavage faces. It has been shown that the crystal growth on these faces is incoherent. Zinc sulfide faces produced artificially by cutting and polishing single crystals of zinc sulfide have also been used and again in this case it has been found that the crystals do not form as a single crystal but as crystallites starting from different centers distributed at random over the surface.

These experiments are being continued with more precise temperature determination in the vapor phase and a control of the rate of condensation.

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Publication No. 986

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## INVESTIGATION OF NUCLEAR REACTIONS AND SCATTERING PRODUCED BY NEUTRONS

Raemer Edgar Schreiber, Thesis (Ph.D.)  
Purdue University, 1941

The construction and performance of a neutron generator consisting of a low-voltage arc and an accelerating tube is described. Deuterons are formed by ionization of heavy hydrogen gas in the arc source, focussed by an electrostatic lens system and accelerated by a Van de Graaff-type generator. When these ions fall on a target of heavy ice, neutrons are formed by the deuteron-deuteron reaction.

A study of the relative activities of the 54-minute and the 4.1-hour period of indium is made, showing that the latter period is activated principally by fast neutrons. Absorption measurements give a cross-section for resonance neutrons in indium which agrees with previous values.

Two separate attempts are made to detect the diffraction of neutrons, using a focussing method. Results are not conclusive because of high background and low intensities, but indicate that the diffraction intensities must be small.

The effect of neutron energy on the mode of uranium fission is investigated, using neutrons from the Be-D and Li-D reactions in the cyclotron, a special ionization chamber, linear amplifier and recording oscillograph. Plots of the number of pulses versus recoil energy of the fragments are made. With slow neutrons, an energy distribution of single fragments agreeing with that of former investigations is found. With fast neutrons, three new modes of fission are assumed to exist: highly asymmetrical binary, symmetrical binary and symmetrical ternary.



By applying the law of conservation of momentum, it is possible to calculate the relative masses of the fragments in each case. The results agree with those obtained by using chemical analysis.

Using a uranium layer on a thin supporting foil, measurements on the total ionization are made. These agree with the energies calculated from the single fragments and correspond with those calculated theoretically.

The energy loss by single fragments which have traversed the supporting foil agrees closely with that calculated from the cross-sections given by Knipp and Teller.

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Publication No. 987

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## INDUCED POLARIZATION: A METHOD OF GEOPHYSICAL PROSPECTING

David Franklin Bleil, Thesis (Ph.D.)  
Michigan State College, 1948

The literature pertaining to geophysical prospecting by the use of induced polarization is reviewed and found to be vague, inconsistent and in error. Laboratory experiments, designed to study the fundamental relations involved in the process of inducing a polarization potential on a metallic object in an electrolyte, are described. It is concluded from the results of these experiments that: a) the potential induced is a linear function of the potential gradient until a potential of 1.2 v has been established across the object. Beyond this potential a saturation effect begins. b) diffusion and chemical action of the products of polarization play the predominant roles in the determination of the rate of growth and decay of the polarization potential. c) to a first approximation, only metallic or metallic-like objects are polarizable. The polarization of a cell containing  $\text{CuSO}_4$  surrounded by tap water is an exception but it is a second order effect. d) metallic particles disseminated throughout an unpolarizable matrix are polarizable. A theoretical development based on these conclusions is given for the induced polarization potential developed: a) in a homogeneous uniformly mineralized earth, and b) by a buried sphere, each under the action of a point electrode. The results obtained from the mineralized earth are used to define the "induced polarization susceptibility" and to describe a method for analyzing field data. Field results obtained by induced



polarization measurements over one two-formation contact plane (Manassas Sandstone and Wissahickon Fault) and over two mineralized zones (Pyrrhotite and Magnetite) are described and interpreted. These results are in agreement with the theory as developed.

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Publication No. 989

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## QUANTIZATION AND ELECTRIC INTERACTION IN DIATOMIC MOLECULES

Theodore Berlin, Thesis (Ph.D.)  
University of Michigan, 1944

The purpose of this thesis is to develop a new approach to the subject of molecular binding which utilizes and extends the advantages of previous theories. The main result is that the various types of binding can be understood in terms of the electric interaction within and between quantized parts of the molecules, if the charge distribution given by wave mechanics is taken into account.

The thesis is predominantly concerned with the behavior of diatomic molecules. The principles derived in cooperation with K. Fajans have been applied by him to systems of greater complexity.

In Chapter II, the theory and reliability of the atomic and molecular data used are briefly discussed. In Chapter III, the Bohr model of simple atoms and molecules is compared with the results of wave mechanics and experiments. It is shown that the failure of the Bohr model is essentially due to the fact that it gives an incorrect charge distribution for a given quantization.

Chapter IV deals with diatomic molecules of elements in the first two rows of the periodic table. Molecules are described in terms of units called "quanticules". A quanticule is a group of electrons which constitutes a unit with respect to quantization, that is, all these electrons are quantized with respect to the same field of positive charges or cores. For example, the electrons of the ion  $\text{Na}^+$  form a quanticule quantized to  $\text{Na}^{11+}$ ; the electron pair binding the two  $\text{Li}^+$  in  $\text{Li}_2$  is a quanticule which is quantized to both  $\text{Li}^+$  cores.



It is shown that the quanticule formulation allows a comparatively simple understanding of the gradations of molecular properties. In particular, the common feature of the electronic structure of molecules usually formulated as having a triple bond ( $N_2$ , HCN,  $C_2H_2$ ) is considered to be a closed group of 10 electrons.

In Chapter V the pairing and unpairing of electrons is discussed on the basis of the Pauli principle and of attractive and repulsive forces between nuclei and electrons. It is emphasized that electron pairing is not fundamental for chemical binding and that two unpaired electrons can occur in ground state of some molecules due to intramolecular repulsive forces.

The method of quantization proposed above is applied in Chapter VI to the monohydrides of various elements. It is suggested that hydrogen can exist in molecules either as  $H^+$  embedded in an electronic shell which it has in common with other cores or as  $H^-$  which is more or less polarized and tightened by a combining cation. Correspondingly, it is shown that it is possible to assign most of the known monohydrides to one of two classes. The monohydrides of elements of Groups I, II and III of the periodic system are assigned to the class  $H^-$  and are formulated as  $n^{z-1} (M^{z+}) H^-$ , when  $n$  is the principal atomic quantum number of the  $z-1$  valence electrons quantized in respect to  $M^{z+}$ . Monohydrides of elements of Groups V, VI, and VII are assigned to class  $H^+$  and are formulated as  $n^{z+1} (M^{z+}, H^+)$ ; the  $z+1$  electrons are considered as quantized to both cores. The assignment of the monohydrides of Group IV elements has been left open, since their properties are not precisely enough known.

In Chapter VII, the theory of electronic binding is discussed. It is demonstrated that wave mechanics substantiates the electrostatic concept of binding. The change in the strength of binding, resulting from the addition of an electron to an already stable system, is interpreted in terms of the ideas of quantum configuration and electric interaction.

The thesis is concluded with a discussion of the Heitler-London and Hund-Mulliken theories of molecular structure and the connections of the present work with these and older theories are shown.

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Publication No. 1041

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# AN INVESTIGATION OF THE PHOTO-ELECTRIC MECHANISM IN THE THALLOUS SULFIDE PHOTO-CONDUCTIVE CELL

Arno Wilfred Ewald, Thesis (Ph.D.)  
University of Michigan, 1948

An experimental study of thallous sulfide photo-conductive cells is presented together with a phenomenological theory which is based upon the results of this study and the previously determined fundamental properties of these cells. The experimental investigation includes determinations of the dependence upon light intensity and temperature of the rise and decay characteristics of the response, measurements of the temperature dependence of the steady-state dark and photo currents, and an investigation of the dependence of the cell noise upon frequency, light intensity and applied voltage.

The simple bimolecular theory which has previously been proposed is shown to be inadequate for the explanation of the shape of the rise and the decay characteristics which are measured when the exciting radiation is suddenly turned on and off, respectively. The shape of these curves indicates that there is some delay mechanism which retards the approach of the transient response to its equilibrium value. As a first step toward the formulation of a more satisfactory theory, a very general theory, in which no assumptions are made concerning the recombination mechanism, is employed in the analysis of the dependence of the initial slopes of the response characteristics upon light intensity and temperature. Through this analysis it is shown that (1) the mobility of the charge carriers is temperature dependent and that the activation energy determining this dependence is 0.19 e.v., and (2) the charge carrier density produced by strong illumination decreases with increasing temperature.



The photo-electric mechanism is explained in terms of an energy level diagram in which the oxygen impurity levels comprise a band below the conduction band of the pure material. Photo-electrically excited electrons are raised from the full band to the conduction band and then fall to the impurity levels with a high combination probability. The immobile  $O^-$  ions thus formed constitute disturbance centers which, during their lifetimes, allow mobile holes to traverse the material. The electrons in the impurity levels are re-ejected to the conduction band by the thermal motion and may then recombine with the positive holes. The slow approach of the photo-current to its equilibrium value which is exhibited by the rise and decay characteristics is attributed to the small probability of the electrons in the lowest impurity levels being ejected to the conduction band.

The energy differences represented in the energy level diagram are evaluated from the experimentally determined temperature dependence of the dark and photo currents, and in those cases in which the same quantities can also be evaluated through the application of the general theory to the rise and decay characteristics good agreement in the numerical values is obtained. It is found that the lower limit of the impurity band is 0.30 e.v. above the full band and 0.24 e.v. below the conduction band.

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Publication No. 1044

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# A THEORETICAL STUDY OF THE DIRECTIONAL CORRELATION OF SUCCESSIVE NUCLEAR RADIATIONS

David Leo Falkoff, Thesis (Ph.D.)  
University of Michigan, 1948

The data necessary to completely determine a correlation in the directions of particles emitted in two successive nuclear disintegrations are shown to be of two types. First, there are the data associated with the rotational invariance of the description of the nuclear states and emitted radiations, namely, their parities and angular momenta. Secondly, the physical description of the emitted particles must be given in the form of an interaction Hamiltonian. The information of the first type determines the relative intensities of the components of the line for each transition and also the selection rules for the individual radiations. The physical description of the particles enters the correlation functions through the specification of the angular distributions associated with each component of a line.

A discussion is given of the relationship between the degeneracy of the nuclear states and the isotropy of the emitted radiations. Using isotropy considerations, relations between rotational matrix elements and constraints on the angular distributions are derived for the cases when the angular momentum of the emitted particles is  $L = 1$  or  $2$ . These relations make it possible to express the correlation functions in canonical forms which can be specialized to different correlations:  $\gamma$ - $\gamma$ ,  $\beta$ - $\gamma$ ,  $\beta$ -internal conversion,  $\gamma$ -internal conversion, etc.

The  $\beta$ -angular distributions, which depend in general on the nuclear charge  $Z$ , the upper energy  $\omega$  of the  $\beta$  spectrum and the choice of  $\beta$  interaction, are here obtained for all the five standard  $\beta$  interactions with  $Z = 0$  for  $L = 1, 2$ .

The  $\beta$ - $\gamma$  correlation functions are tabulated for successive emissions in which the  $\beta$  transition is allowed, first forbidden or second forbidden and the  $\gamma$  transition is dipole or quadrupole. It is shown that the  $\beta$ - $\gamma$  correlation provides a sensitive means of distinguishing between the  $\beta$  interactions and for determining the degree of forbiddenness of the  $\beta$  transition.

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AN ANALYSIS OF THE INFRARED SPECTRA OF THE  
NORMAL PARAFFIN HYDROCARBONS AND THE FAR-INFRARED  
SPECTRA OF CARBON TETRACHLORIDE

David Murray Gates, Thesis (Ph.D.)  
University of Michigan, 1948

The purpose of this dissertation was to determine the molecular constants of the normal paraffin hydrocarbon molecules and to classify as completely as possible their infrared and Raman spectra. The main emphasis was directed towards an analysis of the skeletal normal modes of vibration with the object of calculating from these the force constants involving the interactions of the  $\text{CH}_2$  and  $\text{CH}_3$  groups within the molecule. These molecules, propane, butane, pentane, etc., were assumed to have the forms of planar zig-zag chains. The analysis necessitated the experimental determination of the frequencies in the far infrared, the partial resolution of certain of the bands in the near infrared, and the theoretical analysis of the skeletal modes of vibration.

In the far infrared from  $25\ \mu$  to  $60\ \mu$  the gases of n-propane, n-butane, n-pentane and carbon tetrachloride were studied. The following frequencies were established:

n-propane	$370.6\ \text{cm}^{-1}$
n-butane	$215\ \text{cm}^{-1}$
n-pentane	no bands were found, probably because they were too weak.
carbon tetrachloride	$15\ \text{cm}^{-1}$

The carbon tetrachloride band found at  $315\ \text{cm}^{-1}$  had previously been found in the Raman spectra and

in the infrared only with very low resolution. The present investigation resolved the band into P, Q, and R branches but not into distinct fine structure lines. In the near infrared several bands of n-butane (gas) and n-pentane (liquid) were studied under high resolution. The n-butane bands were partially resolved, but the fine structure measurements were not sufficient to give an accurate determination of the moments of inertia. The centers of the bands investigated were found to be at: (The symbol Q indicates that the bands possessed a Q branch)

N-butane		n-pentane
1342.9 $\text{cm}^{-1}$	Q	1167 $\text{cm}^{-1}$
1295.6	Q	1141
1135.6	Q	1072
956.5	Q	914
747.8		
733.2		

Following a normal coordinate calculation using a valence force potential the force constants necessary to characterize each of the molecules of the saturated normal paraffin hydrocarbon was determined. Ethane is the first member of the series and each larger molecule required one additional force constant. The following values were obtained for the force constants by means of a least square adjustment to the observed frequencies. (The subscripts on the k relate to the number of hydrogen atoms associated with the various carbon atoms and the force constants are measured in degrees/cm).

Molecule	$k_{32} \times 10^{-5}$	$k_{22} \times 10^{-5}$	$k_{p322} \times 10^{-5}$	$k_{p222} \times 10^{-5}$	
Ethane	4.36				180°
Propane	3.88		0.333		115°
Butane	3.80	3.525	0.210		120°41'
Pentane	3.80	3.57	0.125	0.241	117°25'

Publication No. 1047

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THE THEORY OF THE ANGULAR CORRELATION  
OF SUCCESSIVE GAMMA AND INTERNALLY  
CONVERTED GAMMA RADIATIONS

Daniel Seth Ling, Jr., Thesis (Ph.D.)  
University of Michigan, 1948

A study is made of the angular correlation between the directions of emission of successive gamma and internally converted gamma radiations. It is shown that the determination of such correlations will yield valuable information concerning the parity and angular momenta of the nuclear states involved.

The determination of the angular correlation may be resolved into the determination of two factors. The first factor is the relative probability of a transition between two magnetic sublevels of the nuclear states. The second factor is the angular distribution of the radiation emitted when the nucleus makes a transition between two magnetic sublevels.

The angular distribution function for an internal conversion transition is found to contain a parameter which depends on integrals of the radial, hydrogenic eigenfunctions. An exact evaluation of this parameter requires a numerical integration. For this reason, three approximate evaluations of the parameter are given. The parameter is shown to depend, in general, upon the energy of the converted gamma ray, upon the nuclear charge, and upon the parity change of the transition.

Tables giving the angular correlation in terms of the parameter of the angular distribution function are given. These tables include all cases for which the angular momenta of the emitted radiations are less than or equal to two.

The question of gamma-gamma correlation when one of the transitions is a mixture of electric quadrupole and magnetic dipole emission is considered briefly. It is shown that the interference of the two multipoles may strongly affect the angular correlation. The application of the theory to internal conversion-internal conversion correlation is also treated.

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Publication No. 1062

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## THE MEASUREMENT OF LIFETIMES OF SHORT LIVED METASTABLE STATES IN NUCLEI

Leon Madansky, Thesis (Ph.D.)  
University of Michigan, 1948

The classification of metastable states with respect to the associated angular momentum and parity quantum numbers is discussed. It is shown that an interpretation of the experimental values of lifetime and conversion coefficient can lead independently to L values; however, this identification is based upon too specific a nuclear model to yield undisputable results. The need for simultaneous measurements of lifetime and internal conversion coefficient is made clear; the first determining a feasible L value, the other checking the L value and possibly determining the symmetry character of the transition((i.e. electric or magnetic type radiation)). Some data is given to illustrate such a program.

A method is described in which a single sweep oscilloscope is used to measure time differences between the initiation and decay of the metastable state of a nucleus. A discussion of the dependence of the counting rates on both the physical set-up and the disintegration scheme is presented, and a method of determining the internal conversion coefficient is given. The limitation of the method due to inherent delay errors in the Geiger counters is exhibited and corrections are derived. A general discussion of the statistical errors in lifetime experiments is also given. Details on the characteristics and the construction of the circuits and counters are outlined.

The results on lifetimes were  $22 \pm 1$  microseconds for  $\text{Ta}^{181}$  and  $.07 \pm .02$  microseconds for  $\text{Hg}^{198}$ . Further work is outlined for improving measuring techniques and for carrying through an experimental program that would result in the determination of the quantum numbers for metastable levels.

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Publication No. 1064

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ARTIFICIAL RADIOELEMENTS AS TRACERS  
IN THE STUDY OF THE ADSORPTION OF  
EOSIN AND ERYTHROSIN ON SILVER BROMIDE

Amos S. Newton, Thesis (Ph.D.)  
University of Michigan, 1943

A study has been made of the mechanism of the adsorption of eosin and erythrosin on silver bromide using artificially produced radioelements as tracers.

Using the sodium salts of dyestuffs made with radiosodium, it has been shown that when the eosin or erythrosin anions are adsorbed on silver bromide from an equivalent solution, or when eosin ions are adsorbed on AgBr from a  $5 \times 10^{-4}$  M  $\text{AgNO}_3$  solution, no sodium ions were adsorbed as counter ions.

Using AgBr\* containing radiobromine as the adsorbent, a quantitative study of the release of bromide ions to the solution accompanying the adsorption of eosin and erythrosin has been made. It was found that from an equivalent solution about 1.3 bromide ions are released per erythrosin ion adsorbed. Using eosin it was found that on adsorption on AgBr\* from solutions containing less Ag than is equivalent to the eosin adsorbed, the ratio of bromide ions released to eosin adsorbed decreased with increasing amount of Ag in solution.

The amounts of bromide ions released to the solution as a result of adsorption of erythrosin on AgBr\* were found to depend on the pH of the solution. Per one erythrosin ion adsorbed 0.8, 1.3 and 1.7  $\text{Br}^-$  were released at pH values 4.6, 7 and 9 respectively.

An attempt was made to study the behavior of silver ions in the adsorption process, using an excess of radioactive silver in solution. However these experiments revealed only the rapidity of recrystallization of well aged samples of AgBr which caused great



changes in the radioactive composition of the solution and inhibited the study of adsorption of silver ions.

The results of this and of previous investigations<sup>1</sup> lead to the following mechanism of dye adsorption. The primary process is the attachment of the dyestuff anions to the surface of the silver bromide. Silver ions are co-adsorbed with the dyestuff anions to maintain electroneutrality in the system. The silver ions are adsorbed directly from the solution if it contains an excess of silver ions. However if the initial amount of silver ions in the solution is less than equivalent to the adsorbed dyestuff anions, the co-adsorbed silver ions are obtained by dissolution of AgBr. This leads to an increase of the amount of bromide ions in the solution, which fact has been incorrectly interpreted as proof of a direct exchange between the adsorbed dye anions and the lattice anions of the adsorbent. If the dye is the salt of a weak dibasic acid, part will be adsorbed as the monohydrogen ion or as the undissociated acid, the amount being so adsorbed increasing with decreasing pH of the solution.

Two phenomena indirectly connected with the main topic of the thesis were studied. The importance of the adsorption of silver ions on glass from dilute solutions is shown, e.g., by the observation that from a  $1 \times 10^{-5}$  M AgNO<sub>3</sub> solution contained in a one ounce soft glass bottle 45% of the silver was adsorbed within one hour.

A study of the exchange of radioactive Br<sup>-</sup> in solution with the halogen in dyes of fluorescein derivatives was made. Direct exchange was found slow but a reaction activated by the isomeric transition of Br<sup>80</sup> from the 4.4 hour to the 18 min. isomer was found to cause a reaction of Br\* with the dyes with an efficiency in the order:

fluorescein > dichlorofluorescein > eosin > erythrosin

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<sup>1</sup>K. Fajans, J. Appl. Physics 12, 306 (1941).



## THE MEASUREMENT OF THE BETA RAY SPECTRA OF SCANDIUM AND PHOSPHOROUS

Elmer J. Scott, Thesis (Ph.D.)  
University of Michigan, 1948

The spectra of the electrons emitted in the disintegration of radioactive scandium  $_{21}\text{Sc}^{46}$  and of radioactive phosphorous  $_{15}\text{P}^{32}$  were measured with a semicircular focussing spectrometer. The fixed electron path from the source to the Geiger tube detector was defined by very narrow apertures. At any particular setting of the magnetic field electrons of only a very narrow range of momentum were counted by the Geiger tube. In order to count electrons in some other momentum interval it was necessary to change to a new value of the magnetic field strength. The entire spectrum of each of the above radioactive isotopes was covered by a systematic variation of the magnetic field.

The Geiger tube employed detected all electrons with energies in excess of 25 kilovolts with equal efficiency. This was made possible by the use of an extremely thin collodion film window on the Geiger tube.

The primary purpose of the investigation was to measure the shapes of the above mentioned electron spectra. The scandium disintegration is singly forbidden, and the phosphorous disintegration doubly forbidden according to the Fermi selection rules for such disintegrations. The purpose in measuring the observed shapes of the spectra agreed with the predictions of the Fermi theory. The previous results for the shape of the forbidden phosphorous electron spectrum were in disagreement. One showed that the number of low energy electrons was in excess of the value predicted by the Fermi theory for allowed transitions. The other result showed no such excess, and in fact the shape of the forbidden phosphorous

spectrum was almost exactly the same as it would be if it were allowed.

The present results indicate that the forbidden electron spectrum of scandium agrees very well with the theoretical values to be obtained for an allowed spectrum, except at the very lowest energies, where fewer electrons are observed than the theory would indicate.

The phosphorous results do not agree with either of the previously published results. The observed numbers of electrons seem to be less than the numbers predicted by the Fermi theory of allowed transitions. In order to test the validity of this conclusion, scattering in the vicinity of the source was purposefully introduced. By this method it was possible to obtain the previous results, thus indicating that the latter may have been error because of such scattering.

The results indicate that the modification of the Fermi theory of allowed disintegrations to fit the case of the doubly forbidden phosphorous disintegrations should be in the direction of decreasing the number of electrons.

The maximum energy of the electrons emitted in the disintegration of scandium was found to be  $0.335 \pm 0.003$  MEV. The corresponding value for the phosphorous disintegration is 1.72 MEV.

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Publication No. 1074

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THE DESIGN OF A MAGNETIC DOUBLE-FOCUSSING  
BETA RAY SPECTROMETER AND THE BETA SPECTRA  
OF EUROPIUM AND TUNGSTEN

Franklin Buckley Shull, Thesis (Ph. D.)  
University of Michigan, 1948

A study has been made of beta and gamma radiations from certain isotopes of europium and tungsten, using a new type of beta ray spectrometer known as the magnetic double-focussing spectrometer. This instrument is characterized by unusually high resolving power, and also makes possible Geiger-Muller counting rates which are higher than in a conventional  $180^\circ$  spectrometer of similar size. The spectrometer employs an inhomogeneous magnetic field with cylindrical symmetry whose "shape" is similar to that used in betatron or synchrotron ring magnets. In a median symmetry plane, the vertical magnetic field obeys the relationship

$$H = H_0 \left[ 1 - \frac{1}{2} \left( \frac{r-a}{a} \right) + B \left( \frac{r-a}{a} \right)^2 \right]$$

where  $H_0$  is the field at the radius  $r = a$ , and  $B$  is an adjustable parameter. The theory of focussing is developed by perturbation methods, complete through second order. In zeroth approximation, the electron orbits are circular with radius  $r = a$ . In first approximation, the electron undergoes two simultaneous in-phase sinusoidal oscillations, one vertical, the other horizontal, about the zeroth order circular orbit. A small beta-emitting source forms a common node for both oscillations, while a Geiger-Muller counter is located at the next common node, one half-cycle removed from the first. The source and counter are separated by an angular displacement  $\pi\sqrt{2} = 255^\circ$ . There are second order orbital perturbations whose effects can be minimized through



careful choice of the parameter  $B$ . Image formation as a function of  $B$  is discussed in detail, and it is shown that the spectrometer which was built ( $B = 1/8$ ) is capable of 0.3% maximum resolving power. If  $B = 1/4$ , such a spectrometer will give better than 0.2% maximum resolving power.

With this spectrometer the electrons and gamma rays emitted by  $\text{Eu}^{152}$ ,  $\text{Eu}^{154}$  and  $\text{W}^{185}$  have been investigated. The two europium isotopes, which have about the same half-life (5-8 years), were produced by  $(n, \gamma)$  reactions, and are inseparable in practicable quantities. Two beta spectra ( $\text{B}^-$ ), with maximum energies of 0.751 Mev. and 1.575 Mev., and ten internal conversion lines were found. A Pb photoelectron spectrum revealed the presence of other gamma transitions not indicated by the conversion spectrum. Interpretation of these radiations is made difficult by the presence of two isotopes. Several interpretations are discussed, and the most plausible of these suggests that nuclear transitions of energy 123, (124), 247, (286), 344, 412, (442), 772, 959, 1082, and 1402 Kev. are present, where the parentheses indicate uncertainty. An argument is presented which strongly suggests that certain of these are definitely associated with  $\text{Eu}^{152}$ , not  $\text{Eu}^{154}$ .

$\text{W}^{185}$  is a pure beta-emitter of 77 day half-life, produced by an  $(n, \gamma)$  reaction. The spectrum was measured three times from sources of different thickness. An attempt to extrapolate to zero source thickness proved to be dangerously uncertain. The spectrum has a maximum energy of 0.43 Mev. and has the shape of a theoretically allowed spectrum down to 0.10-0.15 Mev. Below this energy, a surplus above theoretical predictions is observed, with some questionable indications of a deficiency at very low energies.

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Publication No. 1076

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# THE DESIGN OF AN ALPHA-RAY SPECTROGRAPH AND A STUDY OF THE ALPHA-RAY SPECTRUM OF POLONIUM

Walter Geoffrey Wadey, Thesis (Ph.D.)  
University of Michigan, 1948

The design and construction of an alpha-ray spectrograph and an instrument for the measurement of magnetic field distributions are described. An electromagnet with pole faces two feet in diameter was used and the resolution of the spectrograph was 0.2 per cent.

Measurements of the alpha-ray spectra of polonium mounted on nickel, silver, and cadmium are reported and discussed. On nickel the spectrum consists of a single line at 5.300 Mev and a smooth tail extending to lower energies. On silver the spectrum, in addition, shows a plateau extending to 5.1 Mev tailing off below to values comparable with the spectrum on nickel and at 5.3 Mev, the intensity is relatively higher than that on nickel. On cadmium, the plateau has a higher intensity and greater slope. The spectrum tails off to lower intensity but the intensity of the 5.3 Mev line is much lower than that on nickel.

The weak line series reported by Chang is not apparent even though the data are strictly comparable with Chang's since the intensity found for the spectrum of polonium on nickel at the position 0.25 Mev below the 5.300 Mev line is 0.15 per cent of that of the 5.300 Mev line compared to 0.1 per cent for the same position in Chang's data.

To explain the data described here and also that of Chang, the hypothesis is proposed that the alpha-ray spectra seen to date have not been due to the element polonium but to the diffusion of the polonium into the mounting metal. It is substantiated by the work of Focke who found that polonium is segregated into approximately equally spaced regions within

single metal crystals resulting in the emission of alpha-particles in groups approximately equally spaced in energy. Also, the shape of the lines found by Chang is shown to support this hypothesis. Further, the spacing of the weak line series found by Chang is shown to agree with the spacing of the slip bands in metals.

It is suggested that work on the alpha-ray spectrum of polonium be continued with this instrument using polonium salts mounted on organic films. It appears that the alpha-ray spectrographic technique described may be useful for the investigation of the structure of metals.

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Publication No. 1083

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## POLITICAL SCIENCE

### JAPANESE OCCUPATION OF THE PHILIPPINES WITH SPECIAL REFERENCE TO JAPANESE PROPAGANDA, 1941-1945

Rafaelita Vasquez Hilario Soriano, Thesis (Ph.D.)  
University of Michigan, 1948

Japanese propaganda in the Philippines is so intimately related to Philippine history that a historical background is necessary for understanding the former. This dissertation, therefore, gives the history of the slender Japanese-Philippine relations before the American period which were later magnified out of proportion to their importance as the "traditional friendship" propaganda line of the occupation.

Japan's anti-American propaganda among the Filipinos began soon after Dewey's victory in the battle of Manila Bay, and simultaneously, the first tentative gropings of Japan toward her concept of the "Greater East Asia Co-Prosperity Sphere" emerged.

Actual Japanese economic penetration and colonization in the Philippines were effected gradually since 1903 down to the outbreak of the Pacific war. Concurrent propaganda fundamentally aimed at gaining Filipino adherence to Japanese political objectives before the war, were expanded into six general lines during the occupation: (1) Emphasis on "traditional friendship" and racial affinity between the Japanese and the Filipinos. (2) Creation or intensification of race prejudice against the white race, particularly the Anglo-Americans. (3) Glorification of Japan and her "superior Oriental culture." (4) Representation of the puppet Philippine Republic in the best light. (5) Presentation of the Greater East Asia Co-Prosperity Sphere as an Oriental Utopia. (6) Denial that the guerrilla movement could succeed or that America could return.

The race prejudice line was as effective as any, since it had some justification but its effect did



not seem to be particularly great, as is indicated by an analysis of the reports to the United States War Department of 158 American escapees from Japanese prisoner-of-war camps, guerrillas, and civilians, which reveals that 95 percent of the Filipinos even in their darkest hour, readily risked their lives to befriend individual Americans.

The continuation of a joint Philippine-American guerrilla effort never gave the subjugated Filipinos a chance to favor Japan against America without disloyalty to their own brothers who were still maintaining resistance in the mountains. America, in spite of some deficiencies and failures, had acquired the respect of Filipinos: she had built up a democratic educational system, raised the standard of living, and established a government by Filipinos in consonance with their natural democratic leanings. Above all, it was not doubted that the Americans would definitely grant full Philippine Independence in 1946.

On the other hand, the Filipinos saw the disparity between Japan's promises and the reality of her regime, for gross injustices and abuses were perpetrated by the Japanese. Because of their superficial knowledge of Filipino psychology, the Japanese preached, scolded, shouted and threatened, instead of quietly guiding the Islanders into the Oriental fold. Of all the reasons for the failure of Japanese propaganda in the Philippines, however, the greatest was that the Filipino never believed that his cause was lost and pinned his faith to the ultimate success of the guerrilla movement and the return of the Americans.

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Publication No. 1078

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## PSYCHOLOGY

### CONSISTENCY OF THE FACTORIAL STRUCTURES IN PERSONALITY RATINGS FROM DIFFERENT SOURCES

Donald W. Fiske, Thesis (Ph.D.)  
University of Michigan, 1948

During an intensive program of personality evaluation, the same 128 men were rated by three sets of people: (1) a staff team of three experienced psychologists pooled their judgments, which were based on a mass of extensive and intensive material on each subject; (2) three teammates who had spent seven days with a subject, living and working together, rated him (the median rating was used in this study); (3) the subjects rated themselves. The same 22-item scale for surface behavior, adapted from Cattell, was used throughout.

Three separate factor analyses were carried out, in each of which five factors were located. Four factors recurred in each study. One factor present in each analysis was essentially a general factor which appeared to be a form of Social Adaptability. A factor labelled Emotional Control showed a close congruence from study to study. A Conformity factor was identified in each of the three sets of ratings, although the three versions of this pattern were somewhat different. A factor of intellectual curiosity or the Searching Intellect was also found in each analysis. Two factors, one from ratings by teammates and one from self-ratings, seemed to embody a common core called Confident Self-Expression. One factor in staff ratings could not be identified and had no definite counterpart in the other sets of factors.

These findings bear certain marked resemblances to those from studies by Cattell and others, although many discrepancies are also present. It is concluded

that, for ratings of relatively manifest behavior, a high degree of consistency exists between the factorial structures found in ratings from different sources. Ratings by colleagues contain fairly accurate versions of all the factors which can be identified in ratings by clinicians and in self-rating.

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Publication No. 1046

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EFFECT OF BRAIN INJURY TO THE RAT ON  
SEIZURES PRODUCED DURING AUDITORY STIMULATION

Joan Usher Longhurst, Thesis (Ph.D.)  
University of Michigan, 1948

The purpose of this study was to determine the effects of partial frontal lobectomy on rats that show susceptibility to seizures during auditory stimulation.

A total of 60 albino rats from 10 different litters were divided into three groups of 20 rats each (using a split litter technique) before determining susceptibility to seizures produced during auditory stimulation.

The experiment was designed so that the group treatment was identical with respect to the auditory tests and different with respect to the manipulation of the operation variable. Group I was the unoperated control group; Group II was the post-operated experimental group, i.e., the animals were subjected to operation at the conclusion of the first test series; and Group III was the pre-operated control group, i.e., the animals were subjected to operation 7 days before any auditory tests were made.

In determining the effect of brain operation two measures were used: (1) frequency of seizures; and (2) incidence of susceptibility. It was found that both frequency of seizures and incidence of susceptibility decreased with brain operation. Further, it was found that the factor of "critical" lesion was related to the measure of incidence of susceptible animals. Since operation was found to have had: (1) no effect on the susceptibility of 17 animals; (2) a temporary effect on 7 susceptible animals; and (3) a more permanent effect on at least

2 susceptible animals, an attempt was made to relate these findings to the results of the pathological examination of the animals' brains. When this was done, it was discovered that the 7 susceptible animals that showed a temporary cessation of seizure behavior sustained a "deep" lesion in one hemisphere (i.e., involving injury to the depth of the basal ganglia); the 2 susceptible rats that never showed seizures again for the remainder of the experiment sustained "deep" lesions in both hemispheres; and the 17 susceptible animals that continued to show post-operative seizures sustained either bilateral or unilateral "superficial" lesions.

In view of these experimental findings, it was suggested that the effect of the brain operation may have been due to the degree of interruption in the pathway of the seizure discharge (i.e., in the motor fibers distributing directly to the putamen). It would follow, then, that more complete interference (bilateral "deep" lesions) would result in a more permanent cessation of seizure behavior than complete interference confined to one hemisphere (unilateral "deep" lesions), or incomplete interference in one or both hemispheres (bilateral and unilateral "superficial" lesions).

Contrary to the view that the seizure is audiogenic in nature, the view of this study is that the seizure is a non-specific response that serves to release tensions. It is felt that the evidence herein presented supports this interpretation.

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Publication No. 1063

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## SOCIOLOGY

### THE NORWEGIANS IN BAY RIDGE: A SOCIOLOGICAL STUDY OF AN ETHNIC GROUP

A Study of the Cultural Heritage of the  
Norwegian Group in Brooklyn as it Affects  
Their Behavior, and the Character of the  
Community They Created There

Christen T. Jonassen, Thesis (Ph.D.)  
New York University, 1947

#### The Problem and Its Significance

The object of this research has been to study the cultural heritages of the Norwegians in Brooklyn in relation to the process of assimilation, of culture conflicts, and of reconciliation of these heritages with American culture and institutions.

Norwegians have played an important role in the making of the United States, and have contributed their share to the cultural pattern that developed in America. The majority of them settled in the middle west and north west where their influence is greatest. Much historical material has been published concerning the Norwegians of the west, but the eastern group has received little attention, and it has never been studied from the sociologist's point of view. These findings should be of practical help to the social organizations of the group and those of the larger community. The study of the Norwegians in this country also provides additional data for verification or qualification of sociological concepts and theory.

#### Sources of Data

The data requisite to this study have been obtained from the following sources:

1. Data gathered through participant observation, personal interview, schedule, questionnaire, non-participant, non-controlled observation, autobiographies, letters and life histories.

2. Statistical reports of American and Norwegian governmental agencies.

3. Data developed by such persons as psychiatrists, teachers, social workers, psychologists, and physicians.

4. Norwegian language newspapers and the histories of the various Norwegian churches.

5. Previous academic studies of communities and ethnic groups in this country for methodology as well as data.

6. Norwegian literature from Saga days to the present, and general historical summaries for ascertaining the nature and development of the Norwegian heritage in Europe and America.

7. Sociological and anthropological works for definitions, concepts, theory, and a frame of reference.

### Procedure

The task of studying the cultural heritages of Norwegians functioning in an urban American environment resolves itself into the study of a cultural continuum of which the cultural pattern of the group in Brooklyn is the end result. It was therefore necessary to describe and compare the various societies which made their characteristic contributions to the culture of the Brooklyn community. The attempt was also made to establish in each case the relationship between a particular culture -- its value system -- and the representative basic personality which it produced. To accomplish these objectives the statistical, case study, historical, and ecological methods of research, and a combination of these methods were employed.

### Conclusion

This study indicates that the salient factors of the Norwegian heritage are the Viking, the Christian, and the "New Norway" value systems, and the natural milieu in which these systems imposed various types of social and psychological controls on the societies and the people in the societies in which they operated,



thus producing a distinguishable basic personality for each culture. The present Norwegian culture and basic personality represent a synthesis of these value systems.

The various value systems operating in Norwegian society produce a clash of values which is reflected in the behavior of individuals in the society. This is particularly evident in the Norwegian community in Brooklyn which for the purposes of this study is called Viking Village and where because of immigration the conflict is intensified. The influence of the heritage in interaction with the American milieu is always apparent -- in the ecological, demographic, and vocational behavior of the immigrants, in the characteristics of the Norwegian community developed in Brooklyn, in the social structure of that community developed in Brooklyn, in the social structure of that community, in the type of disorganization from which Norwegian immigrants suffer, and in the nature and problems of the process of assimilation.

Two cultural streams having the same origin meet again after centuries of separation in Viking Village, U. S. A. In the interval, culture elements once alike have undergone different developments under different conditions and the results of such developments for human behavior are profound and dramatically evident.

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Publication No. 977

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## ZOOLOGY

### WATER REQUIREMENTS OF CERTAIN RODENTS FROM XERIC AND FROM MESIC HABITATS

Robert G. Lindeborg, Thesis (Ph.D.)  
University of Michigan, 1948

The daily water consumption, when an abundance of water is provided, differs considerably between genera, species, and races of small rodents. This conclusion is based on measurements of the water consumed by over 500 individuals belonging to eleven races (five species) of Peromyscus, and one race each of Microtus and Perognathus. These genera, species, and races differ also in their ability to survive the effects of progressively reduced water rations. The effects of deficient water were shown by decrease in body weight and often by ultimate death.

The amounts of water consumed by small rodents and their ability to survive on deficient water supply is correlated generally with the aridity of their habitats. In the species Peromyscus leucopus, the subspecies tornillo compared to noveboracensis drank an average of 0.47 cc. less water daily, lost slightly less water from lungs and skin, maintained a higher body weight on each reduction of water ration, and survived eleven days longer. In the species Peromyscus maniculatus, the subspecies blandus compared to bairdii drank 0.21 cc. less water daily, maintained a higher weight level on each deficient water ration, and survived an average of four days longer. Of the several species and races of Peromyscus tested, eremicus survived longest and maintained the highest body weight on reduced water rations. Of all the forms tested, Microtus drank most water and survived least well on deficient water rations. Perognathus



drank least water and was able to survive on no water at all. This probably is correlated with the fact that Perognathus evaporated less water from the lungs and skin than did Peromyscus.

The races which require the least water and are best able to survive on reduced water ration live in the more xeric climatic areas. Within each climatic area those races which are better able to survive water deficiency, occupy the presumably more xeric habitat.

Breeding females of Peromyscus maniculatus bairdii drank more water than non-breeding females. Thirty-six per cent more was consumed the day before parturition and 158 per cent more just before the young are weaned.

All forms tested were demonstrated to be capable of surviving considerable shortages of water. It appears that most individuals of each form would have no difficulty in surviving all but the most severe drought conditions in the habitats in which they live. Rearing young under conditions of water deficiency, however, would be difficult or impossible for all these rodents, except possibly for the races best adapted to arid habitats.

The ability to survive a deficient supply of water is evidently a taxonomic character of xeric races which must be inherited in much the same way as morphological traits. In the evolution of races and species adapted to xeric habitats selection for adaptive physiologic characters must have played an important role. Adjustment of breeding season to coincide with seasons of the year when sufficient water is available to bring young through to weaning age is an especially important adaptation which presumably also is subject to selection.

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Publication No. 1061

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SOME ASPECTS OF THE CARBOHYDRATE METABOLISM OF  
THE KINGSLAKE (LAMPROPELTIS GETULUS FLORIDANA)

Mahlon Clifton Rhaney, Thesis (Ph.D.)  
University of Michigan, 1948

In order to establish an average value and a range for the blood-sugar concentration of another variety of snake, blood-sugar determinations were made on twenty-seven snakes (Lampropeltis getulus floridana) that had fasted for periods ranging from minimums of 7 to 259 days. The range of blood-sugar concentrations obtained was 55-128 mg%, with an average value of  $91 \pm 4$  mg%. No significant relationship between body weight and blood-sugar concentration was observed. Further, the effect of fasting upon the blood-sugar level is not apparent until after a fasting period of more than fifty-six days. There is, however, an appreciable diminution (ca, 40%) in the blood-sugar concentration after 251 days of fasting.

For the first time in snakes, and perhaps in any other animal, the correlation between blood-sugar concentration and the glycogen reserves of the liver is determined. A Correlation Coefficient of 0.98 was obtained and an Equation of Prediction derived:  $y = -1.715 + 0.222x$ . The latter permits of the estimation of liver glycogen (y) from a known resting, post-absorptive blood-sugar concentration (x) within 1.049 mg/gm of tissue with an assurance of 68%. Blood sugar:liver glycogen ratios (x/y) of 4.4 - 5.6 were obtained, with an average value of  $5.0 \pm 0.09$ . Using this ratio, it is also possible to estimate the level of liver glycogen by determining the blood-sugar concentration.

Glucose tolerance tests indicate that it is possible, using snakes, to obtain significant glucose tolerance curves by taking blood from the same animals



throughout the test. These findings are at variance with those of the only other study of the glucose tolerance of snakes in which a different group of animals was used at each test interval. These tests also indicate that the rate of absorption of glucose from the gut of Lampropeltis appears to be inversely related to the initial blood-sugar level - an observation made for the first time on snakes. A procedure is suggested for obtaining "corrected" glucose tolerance curves.

The intramuscular injection of 40 units of insulin per kilogram of body weight induces an initial, and probably insignificant, hyperglycemia of short duration. This is followed by successive periods of hypo- and hyperglycemia of longer duration, 2 and 8-9 hours, respectively. The probable biochemical basis of the effect of insulin upon blood-sugar is discussed.

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Publication No. 1072

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## THE PELVIC MUSCULATURE OF THE LOON (GAVIA IMMER)

Harry Hammond Wilcox, Jr., Thesis (Ph.D.)  
University of Michigan, 1948

This paper contains a description of the forty-one muscles of the pelvic appendage in the Common Loon (Gavia immer), and an analysis of the function of these muscles during swimming. The terminology used is based on that of Hudson (1937), and a table comparing the terminology used by several authors is included.

The loon is unable to walk on land, terrestrial movement being limited to sliding on the breast with the legs being kicked backward simultaneously. In swimming, the legs move along a nearly horizontal plane, the two feet converging until the tips of their toes touch each other.

Of the forty-three pelvic muscles described for birds, the loon has forty-one, the extensor brevis digiti III, described by Gadow (1891) for the Ratitae, and the lumbricalis, described in the Green Heron by Hudson (1937), being absent. There is no femoral insertion nor accessorius semitendinosi for the semitendinosus.

Sixteen muscles restrict movement at the hip- and knee- joints to rotation. The intertarsal is the first joint of the appendage to be free from the body wall and is situated at the level of the base of the tail. The tarsus swings freely on this joint along a nearly horizontal plane. The fixators of the hip- and knee-joints are for the most part well developed and fleshy, though seven of them are strongly tendinous. The retention of fleshy fibers in certain fixators is interpreted as related to the need for elastic structures which may absorb the strains placed upon them, and the appearance of tendons or aponeuroses in other fixators is interpreted as related to the



need of extreme length to span the distances between origin and insertion, to reduce the size and weight of the organs, or to resist wear at points where the organs cross joints or pass through supporting structures.

The anterior tibial protuberance is elongated cranial to form the rotular process. The patella does not contribute to this process, but is a free flake of bone in the common tendon of the iliotibialis and the femoritibialis externus.

Presence of nearly all of the muscles found in birds indicates that the pelvic muscles of the loon are primitive in number, but they and their skeletal parts have become highly specialized for progression in water.

The bony attachments and the functions of the pelvic muscles are summarized in tables. This paper includes forty-one figures on twenty-six plates.

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Publication No. 1082

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THE UNIVERSITY OF CHICAGO  
DIVISION OF THE PHYSICAL SCIENCES  
DEPARTMENT OF CHEMISTRY  
CHICAGO, ILLINOIS 60637

REPORT OF THE  
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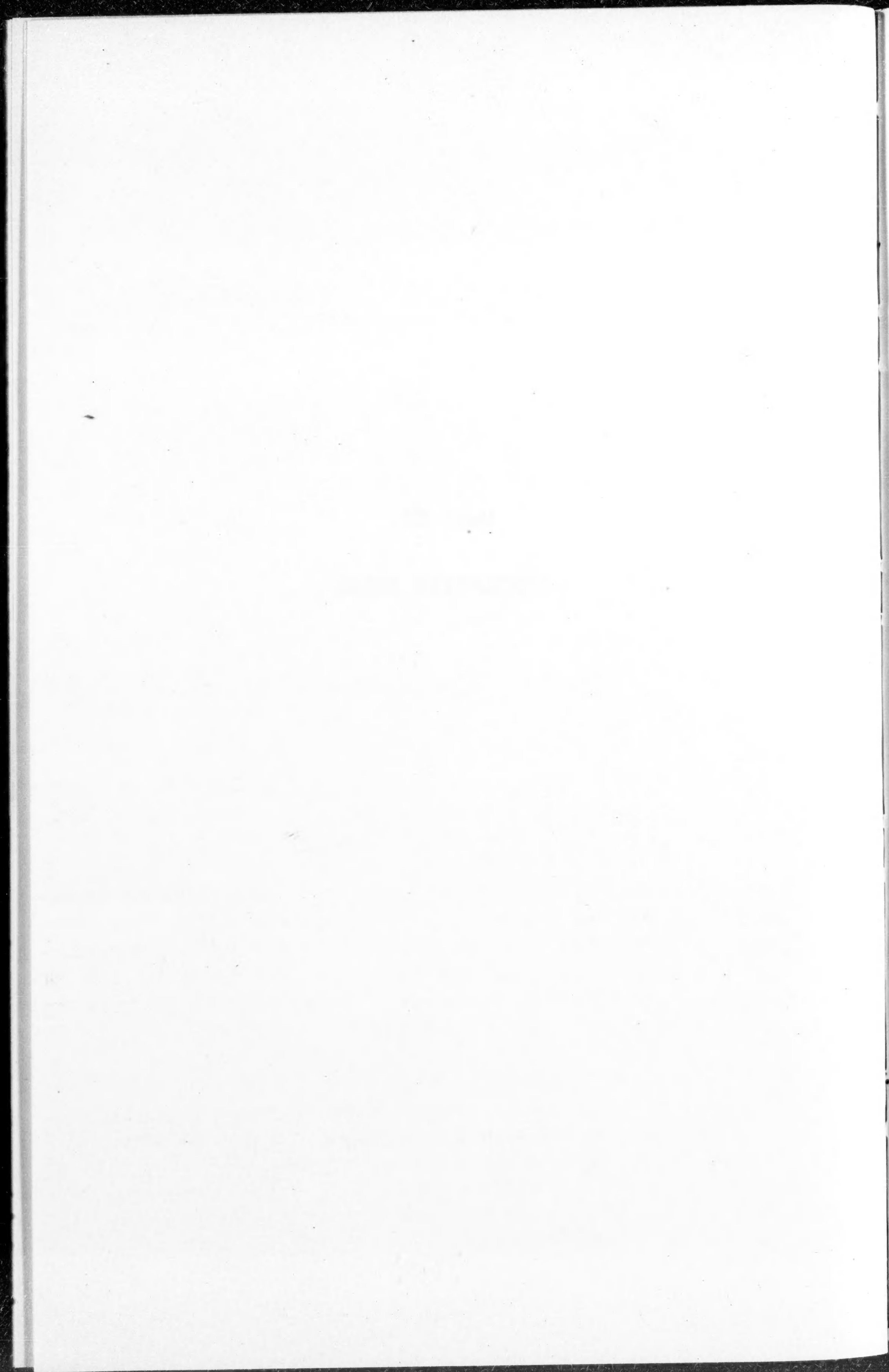
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Part II

CUMULATIVE INDEX





## CUMULATIVE INDEX OF TITLES

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### ART

Later Corinthian pottery. Mary Thorne Campbell, Ph.D. Thesis; Bryn Mawr College, 1941. pp 234, Pub. 797, (M.A. 1946, Vol. VII, No. 1).

ART

Ionic chiton-clad maidens of the fifth century. Cleta Olmstead Robbins, Ph.D. Thesis; Bryn Mawr College, 1942. pp. 239, Pub. 835, (M.A. 1947, Vol. VII, No. 2).

AGRICULTURAL CHEMISTRY

The changes of ash and nitrogen in the germinating Mung bean. Tsing Lai Lau, Ph.D. Thesis; University of Missouri, 1936. pp. 99, Pub. 927, (M.A. 1948, Vol. VIII, No. 1).

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Preparation, purification and refractive index determinations of the methyl, propyl and isopropyl esters of some saturated fatty acids. George William Hunter, Ph.D. Thesis; Pennsylvania State, 1946. pp. 94, Pub. 915, (P.S. 1946, Vol. IX).

The relation of molecular size and chemical constitution of saturated petroleum fractions to their insecticidal efficiency. George W. Pearce, Ph.D. Thesis; Pennsylvania State, 1946. pp. 140, Pub. 899, (P.S. 1946, Vol. IX).

The effect of certain micronutrient elements on the growth and yield of pineapple plants. Francisco J. Ramirez-Silva, Ph.D. Thesis; Pennsylvania State, 1946. pp. 76, Pub. 900, (P.S. 1946, Vol. IX).

ANIMAL PATHOLOGY

Studies on the etiology of specific infectious bovine pyelonephritis. Ernest Star Feenstra, Ph.D. Thesis; Michigan State College, 1947. pp. 108, Pub. 922, (M.A. 1948, Vol. VIII, No. 1).

BACTERIOLOGY

Serologic pretesting of laboratory animals for studies with Hemophilus Pertussis. Paul Fugazzotto,



BACTERIOLOGY

Ph.D. Thesis; Michigan State College, 1947. pp. 69, Pub. 929, (M.A. 1948, Vol. VIII, No. 1).

Studies in bacterial nutrition with special reference to *Clostridium Sordellii*. Henry Dirk Piersma, Ph.D. Thesis; Purdue University, 1941. pp. 129, Pub. 840, (M.A. 1947, Vol. VII, No. 2).

Studies of the effects of oxygen on multiplication and metabolism of *Brucella*. Ruth Evelyn Sanders, Ph.D. Thesis; Michigan State College, 1947. pp. 33, Pub. 932, (M.A. 1948, Vol. VIII, No. 1).

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The Heraklids. Jessie Winifred Alston, Ph.D. Thesis; Bryn Mawr College, 1941. pp. 236, Pub. 887, (M.A. 1947, Vol. VII, No. 2).

BIOLOGICAL CHEMISTRY

The hydrolysis of casein by enzymes with especial reference to the distribution of amino acids in the hydrolysate. John Beck, Ph.D. Thesis; Purdue University, 1937. pp. 98, Pub. 859, (M.A. 1947, Vol. VII, No. 2).

A study of the fat composition and firmness of pork under various dietary conditions. Winfred Quentin Braun, Ph.D. Thesis; Purdue University, 1942. pp. 55, Pub. 849, (M.A. 1947, Vol. VII, No. 2).

Metabolism of creatine. Alice Watson Kramer, Ph.D. Thesis; Purdue University, 1935. pp. 44, Pub. 853, (M.A. 1947, Vol. VII, No. 2).

The formation of glycogen in the liver of the white rat following the administration of certain synthetic organic acids. Mary Louise Lyons, Ph.D. Thesis; Purdue University, 1941. pp. 83, Pub. 863, (M.A. 1947, Vol. VII, No. 2).

BIOLOGICAL CHEMISTRY

The influence of structural configuration on the deamination of amino acids in the normal rat.

Morris Franklin Milligan, Ph.D. Thesis; Purdue University, 1942. pp. 52, Pub. 848, (M.A. 1947, Vol. VII, No. 2).

Blood chlorides of fishes. Dallas K. Meyer, Ph.D. Thesis; University of Missouri, 1947. pp. 192, Pub. 926, (M.A. 1948, Vol. VIII, No. 1).

The influence of certain dietary factors on the production of dental caries in a susceptible strain of rats. Kenneth Jean Olson, Ph.D. Thesis; Michigan State College, 1947. pp. 51, Pub. 916, (M.A. 1947, Vol. VII, No. 2).

The effects of various sources of vitamin D and dihydrotachysterol on the blood calcium and phosphorus levels in cows, dogs, chickens, and rats. Benjamin Hartley Pringle, Ph.D. Thesis; Michigan State College, 1947. pp. 124, Pub. 917, (M.A. 1947, Vol. VII, No. 2).

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The availability to the rat of certain carotenes in raw and cooked vegetables. Marion A. Wharton, Ph.D. Thesis; Michigan State College, 1947. pp. 59, Pub. 888, (M.A. 1947, Vol. VII, No. 2).

The synthesis and intermediary metabolism of some sulfur analogues of cystine: Isocysteine. William J. Wingo, Ph.D. Thesis; University of Michigan, 1946. pp. 121, Pub. 813, (M.A. 1946, Vol. VII, No. 1).



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A study of the factors influencing the release of lead from the tissues of the mouse. Grant Saunders Winn, Ph.D. Thesis; Purdue University, 1940. pp. 130, Pub. 854, (M.A. 1947, Vol. VII, No. 2).

BIOLOGY

Factors affecting the respiration of isolated tissue. Carl McGee Meadows, Ph.D. Thesis; Purdue University, 1941. pp. 74, Pub. 861, (M.A. 1947, Vol. VII, No. 2).

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Effect of nutrition on the reaction of cereals to leaf rust. Kenneth Davis Doak, Ph.D. Thesis; Purdue University, 1931. pp. 195, Pub. 843, (M.A. 1947, Vol. VII, No. 2).

The development of headblight of wheat caused by Gibberella Zeae (Schw.) Petch and Helminthosporium Sativum P. K. and B. Axel Langvad Andersen, Ph.D. Thesis; Michigan State College, 1947. pp. 125, Pub. 919, (M.A. 1948, Vol. VIII, No. 1).

Antiseptic chemicals to inhibit the growth of micro-organisms in nutrient solution cultures containing soluble carbohydrates. Thomas Matthew Eastwood, Ph.D. Thesis; Purdue University, 1948. pp. 139, Pub. 946, (M.A. 1948, Vol. VIII, No. 1).

Terminal elongation of a number of tree species in relation to certain environmental conditions in northern New York. C. Eugene Farnsworth, Ph.D. Thesis; University of Michigan, 1945. pp. 240, Pub. 921, (M.A. 1948, Vol. VIII, No. 1).

Eragrostis in north and middle America. LeRoy Hatfield Harvey, Ph.D. Thesis; University of Michigan, 1948. pp. 304, Pub. 967, (M.A. 1948, Vol. VIII, No. 1).

"White-heads" of grasses. Harry Louis Keil, Ph.D. Thesis; Pennsylvania State, 1946. pp. 39, Pub. 895, (P.S. 1946, Vol. IX).

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The action of allelic forms of the gene A<sub>1</sub> in maize. John R. Laughnan, Ph.D. Thesis; University of Missouri, 1946. pp. 113, Pub. 809, (M.A. 1946, Vol. VII, No. 1).

Aerobic decomposition of cellulose by micro-organisms at temperatures above 40° C. Elwyn T. Reese, Ph.D. Thesis; Pennsylvania State, 1946. pp. 116, Pub. 902, (P.S. 1946, Vol. IX).

Mineral absorption and resistance to wildfire in tobacco. Paul Sacco, Ph.D. Thesis; Pennsylvania State, 1946. pp. 105, Pub. 901, (P.S. 1946, Vol. IX).

CHEMICAL ENGINEERING

A. The effect of composition on the oxidation of hydrocarbon oils. B. The catalytic oxidation of Pennsylvania neutral oils. Neal Devere Lawson, Ph.D. Thesis; Pennsylvania State, 1946. pp. 198, Pub. 896, (P.S. 1946, Vol. IX).

Some calculations of multicomponent separations. Harold S. Ray, Ph.D. Thesis; Pennsylvania State, 1946. pp. 436, Pub. 903, (P.S. 1946, Vol. IX).

CHEMISTRY

The production of drying oils by the chlorination and dehydrochlorination of high molecular weight hydrocarbons. Leland Kenneth Beach, Ph.D. Thesis; Purdue University, 1940. pp. 162, Pub. 847, (M.A. 1947, Vol. VII, No. 2).

The measurement of the heat capacities of 1-nitropropane and nitroethane. G. Victor Beard, Ph.D. Thesis; Purdue University, 1940. pp. 34, Pub. 867, (M.A. 1947, Vol. VII, No. 2).

The animation of heterocyclic compounds. Lloyd Berg, Ph.D. Thesis; Purdue University, 1942. pp. 66, Pub. 846, (M.A. 1947, Vol. VII, No. 2).



CHEMISTRY

I. Organofluorosilanes. II. Experiments in fluorocarbon chemistry. Thomas Jacob Brice, Ph.D. Thesis; Pennsylvania State, 1946. pp. 89, Pub. 913, (P.S. 1946, Vol. IX).

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The following is a list of the papers presented at the meeting of the Society for the Study of the History of the Life Sciences, held at the University of London, on the 10th and 11th of June, 1958. The papers were presented by the following authors: [illegible names and titles of papers]

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